CENTER *for* BIOLOGICAL DIVERSITY

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Via Electronic and Regular Mail (w/ attachments)

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Re: Comments on DEIR on West Valley Specific Plan Amendment

These comments are submitted on behalf of the Center for Biological Diversity on the Draft Environmental Impact Report ("DEIR") for the West Valley Specific Plan Amendment, State Clearinghouse No. 2008041067 ("the Project"). The Center for Biological Diversity ("Center") is a non-profit conservation organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center's Climate Law Institute works to reduce greenhouse gas emissions to protect biological diversity, our environment, and public health. We work to educate the public about the impacts of climate change on our world and the animals and plants that live in it and to build the political will to enact solutions. The Center has over 40,000 members throughout California and the western United States, including San Bernardino County. Center members will be directly impacted by the Project.

According to the DEIR, the Project proposes a massive mixed use development on sensitive and unique endangered species habitat. The Project as proposed will have numerous substantial impacts on the environment due to its nature, size, and location. This letter will focus on the Center's concern that the EIR and the City have failed to adequately analyze and mitigate the Project's greenhouse gas impacts. Curbing greenhouse gas emissions to limit the effects of climate change is one of the most urgent challenges of our time. Fortunately, the California Environmental Quality Act ("CEQA"), Cal. Pub. Res. Code §§ 21000 et seq., 14 Cal. Code Regs. § 15000 et seq. ("Guidelines"), set forth a clear and mandatory process to address the Project's greenhouse gas and global warming impacts. As detailed below, the DEIR must be revised so that it includes a complete and adequate inventory of the Project's greenhouse gas emissions, a full discussion of the impacts from those emissions, a finding that these impacts are significant under CEQA, and a thorough and quantitative analysis of alternatives and mitigation measures to reduce those impacts. The City of Colton cannot lawfully

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approve the project until the required CEQA analysis has been completed and all feasible mitigation measures implemented.

I. The DEIR Fails to Adequately Analyze and Mitigate the Project's Climate Change Impacts

A. The DEIR Omits a Discussion of the Scientific and Factual Background on Climate Change

Climate change poses enormous risks to California. Scientific literature on the impact of greenhouse gas emissions on California (and the world) is well developed. The environmental analysis for this Project must make a good faith effort at full disclosure and avoid minimizing or discounting the severity of global warming's impacts. *See* Guidelines § 15151; *San Joaquin Raptor/Wildlife Rescue Center v. County of Stanislaus*, 27 Cal.App.4th 713 (1994). By failing to discuss the serious threats posed by climate change, the EIR does not fulfill its function as an informational document.

There is no longer credible scientific dispute that the climate is warming. In its most recent assessment, the Intergovernmental Panel on Climate Change ("IPCC") concluded that "[w]arming of the climate is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting snow and ice, and rising mean sea level." (IPCC 2007). The IPCC now states with "very high confidence" that most of the warming observed over the past 50 years is the result of human generation of greenhouse gases, including carbon dioxide, methane, and nitrous oxide. (IPCC 2007).

The California Climate Change Center ("CCCC") has evaluated the present and future impacts of climate change to California and the project area in research sponsored by the California Energy Commission and the California Environmental Protection Agency (Cayan et al. 2007). The severity of the impacts facing California is directly tied to atmospheric concentrations of greenhouse gases (Cayan et al. 2007). According to the CCCC aggressive action to cut greenhouse gas emissions today can limit impacts, such as loss of the Sierra snow pack to 30%, while a business-as-usual approach could result in as much as a 90% loss of the snowpack by the end of the century. As aptly noted in a report commissioned by the California EPA:

> Because most global warming emissions remain in the atmosphere for decades or centuries, the choices we make today will greatly influence the climate our children and grandchildren inherit. The quality of life they experience will depend on if and how rapidly California and the rest of the world reduce greenhouse gas emissions (Cayan et al. 2007).

Some of the types of impacts to California and estimated ranges of severity – in large part dependent on the extent to which emissions are reduced – are summarized as follows:

- A 30 to 90 percent reduction of the Sierra snowpack during the next 100

years, including earlier melting and runoff.

- An increase in water temperatures at least commensurate with the increase in air temperatures.
- A 6 to 30 inch rise in sea level, before increased melt rates from the dynamical properties of ice-sheet melting are taken into account.
- An increase in the intensity of storms, the amount of precipitation and the proportion of precipitation as rain versus snow.
- Profound impacts to ecosystem and species, including changes in the timing of life events, shifts in range, and community abundance shifts. Depending on the timing and interaction of these impacts, they can be catastrophic.
- A 200 to 400 percent increase in the number of heat wave days in major urban centers.
- An increase in the number of days meteorologically conducive to ozone (O_3) formation.
- A 55 percent increase in the expected risk of wildfires (Cayan et al. 2007).

By providing details as to the ranges of proposed impacts, and indicating that the higher-range of impact estimates are projected if greenhouse gas emissions continue to increase under a "business as usual" scenario, decision-makers and the public will be better informed of the magnitude of the climate crisis and the urgency with which it must be addressed.

B. The EIR Understates Project Emissions

CEQA requires that an EIR be detailed, complete, and reflect a good faith effort at full disclosure. Guidelines § 15151. The document "should be prepared with a sufficient degree of analysis to provide decision-makers with information which enables them to make a decision which intelligently takes account of environmental consequences." *Id.* Consistent with this requirement, the information regarding a project's impacts must be "painstakingly ferreted out." *Environmental Planning and Information Council of Western El Dorado County v. County of El Dorado*, 131 Cal.App.3d 350, 357 (1982). Meaningful analysis of impacts effectuates a fundamental purpose of CEQA: to "inform the public and responsible officials of the environmental consequences of their decisions before they are made." *See Laurel Heights Improvement Ass'n v. Regents of Univ. of Cal.* ("Laurel Heights II"), 6 Cal.4th 1112, 1123 (1993).

As currently presented, the EIR's analysis of the Project's greenhouse gas emissions is inadequate, incomplete, and does not reflect a good faith effort at full disclosure. In conducting a greenhouse gas inventory, all phases of the proposed project must be considered. *See* Guidelines § 15126. In addition, the inventory for the project must include the project's direct and indirect greenhouse gas emissions. *See* Guidelines § 15358(a)(1) ("Indirect or secondary effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems."). Quantifying emissions from all potential sources is critical to understanding and mitigating project impacts. Here, the EIR fails to quantify emissions from construction and water usage. In technical guidance for lead agencies on analyzing

the greenhouse gas emissions from project's subject to CEQA, the Office of Planning and Research has stated that greenhouse gas emissions that should be analyzed under CEQA include "emissions associated with vehicular traffic, energy consumption, *water usage and construction activities.*" (California Office of Planning and Research, Technical Advisory, CEQA and Climate Change: Addressing Climate Change through California Environmental Quality Act Review, June 17, 2008 at 5 (emphasis added).) The EIR's arbitrarily omission of the greenhouse gas emissions from these sources violates CEQA.

C. The Project's Determination that Project Greenhouse Gas Impacts Are Less than Significant is Fatally Flawed

A project's impacts require a mandatory finding of significance if they are "cumulatively considerable." Cal. Pub. Res. Code § 21083(b). "'Cumulatively considerable' means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects." Guidelines § 15064(h)(1). Climate change is a classic example of a cumulative effects problem; emissions from numerous sources combine to create the most pressing environmental and social problem of our time. These sources may "appear insignificant when considered individually, but assume threatening dimensions when considered collectively with other sources with which they interact." *Los Angeles Unified School Dist. v. City of Los Angeles,* 58 Cal.App.4th 1019, 1025 (1997). The solution to climate change lies not in any one single action, but in systematically reducing emissions from all possible sources.

The DEIR arbitrarily concludes that the Project's greenhouse gas impacts are not cumulatively considerable because the project would "comply with any regulations promulgated by the CARB and since CARB is not putting any restrictions on growth, this project cannot be seen as interfering with 'California's ability to achieve its GHG reduction requirements." (DEIR at 4.2-49.) The EIR's belief that significance is determined based on compliance with CARB regulations fails on numerous levels.

1. The Appropriate Criteria for Determining Significance of Greenhouse Gas Impacts is Whether the Project Would Interfere With Emission Reductions Necessary to Minimize the Risk of Dangerous Climate Change

CEQA calls for the identification of "any critical thresholds for the health and safety of the people of the state." Pub. Res. Code § 21000(d). With regard to GHGs, this critical threshold is not AB 32 compliance, but avoiding dangerous anthropogenic interference (DAI) with the climate system. Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC) calls for "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference (DAI) with the climate system."[1] With the United States and over 180 other countries as signatories, the UNFCCC's objective of avoiding DAI with the climate is

[1] United Nations Framework Convention on Climate Change, art. 2, May 9, 1992, *available at* http://unfccc.int/essential_background/convention/background/items/1349.php.

widely viewed as the international regulatory standard for protecting the global climate. The environmental objective of avoiding DAI is recognized in ARB's Draft GHG Threshold Guidance. (ARB, Preliminary Draft Staff Proposal, Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under the CEQA ("ARB Draft GHG Threshold"), Oct. 24, 2008 at 3.) In its Policy Objective for the Interim GHG Threshold for Industrial Projects, the South Coast Air Quality Management District ("SCAQMD") sets a roughly analogous objective of "reducing GHG emissions to stabilize climate change." (SCAQMD Interim GHG Significance Threshold Staff Proposal (revised), at 3-2.) The policy objectives of both ARB and SCAQMD's threshold proposals both state that reaching the emission reduction targets set forth by Executive Order S-3-05, whereby emissions are reduced to 80 percent below 1990 levels by 2050, would contribute to avoiding dangerous climate change because these reductions are consistent with a pathway to the stabilization of atmospheric concentrations of GHG emissions at 450 ppm. (ARB Draft GHG Threshold at 3; SCAQMD Interim Threshold Proposal at 3-2.)

Even assuming one could develop a threshold of significance for greenhouse gases based only on near-term 2020 emission reduction targets, reducing greenhouse gas emissions to 1990 levels is not sufficient to put atmospheric concentrations of greenhouse gas emissions on a trajectory to substantially reduce the risk of dangerous climate change. According to the International Panel on Climate Change, developed countries need to reduce emissions to 25-40 percent below 1990 levels by 2020 to stabilize atmospheric greenhouse gas concentrations at 450 ppm CO_2eq.[2] Not only does AB 32 fail to reach this near-term objective, but a stabilization target of 450 ppm CO_2eq provides only a 50/50 chance of limiting global average temperature increase to 2°C (3.6º F) from pre-industrial levels and a 30 percent chance that global average temperature would rise more than 3°C (5.4º F).[3] The consequences of a 2°C temperature increase include the displacement of millions of people due to sea level rise, irreversible loss of entire ecosystems, the triggering of multiple climactic "tipping points" such as complete loss of summer Arctic sea ice and the irreversible melting of the Greenland ice sheet, loss of agricultural yields, and increased water stress for billions of people.[4] As dire as the projected impacts are from a 2°C average temperature increase, increases above 2°C would result in impacts exponentially more devastating. At a 3°C temperature increase from pre-industrial levels, 22 percent of ecosystems would be transformed, losing 7 to 74 percent of their extent.[5] An additional 25 to 40 million people would be displaced from coasts due to sea level rise, an additional 1.2 – 3 billion people would suffer an increase

[2] S. Gupta et al., *Policies, Instruments and Co-operative Arrangements, in* CLIMATE CHANGE 2007: MITIGATION, CONTRIBUTION OF WORKING GROUP III TO THE FOURTH ASSESSMENT REPORT OF THE INTERNATIONAL PANEL ON CLIMATE CHANGE 776 (2007) (by 2050, emissions would need to be reduced to 80 to 95% below 1990 levels).

[3] UNION OF CONCERNED SCIENTISTS, HOW TO AVOID DANGEROUS CLIMATE CHANGE: A TARGET FOR U.S. EMISSIONS 16 (2007); Malte Meinshausen, *What Does a 2°C Target Mean for Greenhouse Gas Concentrations? A Brief Analysis Based on Multi-Gas Emission Pathways and Several Climate Sensitivity Uncertainty Estimates, in* AVOIDING DANGEROUS CLIMATE CHANGE 270-72 (2006).

[4] Rachel Warren, *Impacts of Global Climate Change at Different Annual Mean Global Temperature Increases* in AVOIDING DANGEROUS CLIMATE CHANGE 95, 98 (2006).

[5] *Id.* at 99.

in water stress, and 65 countries would lose 16 percent of their agricultural gross domestic product.[6] Accordingly, leading scientists warn that "to preserve a planet for future generations similar to that in which civilization developed and to which life on Earth is adapted . . . CO_2 will need to be reduced from its current 385 ppm to at most 350 ppm."[7] The U.S. Global Change Research Program recently affirmed this finding.[8] Thus, even if 2020 could be viewed as an appropriate time-frame from which to establish a threshold under CEQA, targeting reductions to reach 1990 levels by 2020 is inconsistent with scientific data on the near-term reductions necessary to avoid dangerous climate change. *See* Guidelines § 15064(b); *Protect the Historic Amador Waterways v. Amador Water Agency* (2004) 116 Cal.App.4th 1099, 1109 (regulatory standards can serve as proxies for significance only to the extent that they accurately reflect the level at which an impact can be said to be less than significant).

2. The EIR's Unsupported Claim that California Will Achieve Its Emission Reduction Objectives Absent Restrictions on Growth Is Without Merit

The EIR's naked assertion that project greenhouse gas impacts are less than significant because California will achieve its emission reduction targets absent restrictions on growth or new development is fatally flawed. First, the EIR provides no evidence supporting the assertion that present and future state regulations are sufficient to achieve the deep emission reductions necessary to minimize the risk of dangerous climate change. Indeed, compliance with potential future regulations is not a legitimate means for determining significance. As stated by the Attorney General, "CEQA is not a mechanism merely to ensure compliance with other laws, and, in addition, it does not allow agencies to defer mitigation to a later date." (Attorney General, Climate Change, CEQA & General Plans (March 2009) at 3.) As similarly opined by the California Resources Agency in its Initial Statement of Reasons on proposed CEQA GHG Guidelines, while CARB may ultimately develop greenhouse gas regulations pursuant to the AB 32 Scoping Plan, the Scoping Plan "may not be appropriate for use in determining the significance of individual projects . . . because it is conceptual at this stage." (Resources, Initial Statement of Reasons at 22.)

Contrary to the EIR's unsupported assertion that compliance with future state regulation will render project impacts less than significant, it is widely recognized that "[r]educing greenhouse gases (GHG) to sustainable levels will require action from international, federal, state, and *local government* and organizations." (EPIC 2009). As

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[6] *Id.* at 96–97.

[7] James Hansen et al., *Target Atmospheric CO_2: Where Should Humanity Aim?* 2 OPEN ATMOSPHERIC SCI. J. 217, 226 (2008). 450 CO_2eq is approximately equivalent to 400 ppm CO_2 stabilization, and 400 CO_2eq is approximately equivalent to 350–375 ppm CO_2 stabilization. Michel den Elzen & Malte Meinshausen, *Multi-Gas Emission Pathways for Meeting the EU 2°C Climate Target, in* AVOIDING DANGEROUS CLIMATE CHANGE 300, 305 (2006).

[8] U.S. Global Change Research Program, GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES at 23 (2009) (finding that "atmospheric concentration of carbon dioxide would need to be stabilized in the long term at around today's levels" to have a "good chance (but not a guarantee)" of avoiding severe, widespread, and irreversible impacts).

specifically recognized in the AB 32 Scoping Plan, "[i]n order to achieve the deep cuts in greenhouse gas emissions we will need beyond 2020 it will be necessary to significantly change California's current land use and transportation planning policies. Although these changes will take time, getting started now will help put California on course to cut statewide greenhouse gas emissions by 80 percent in 2050 as called for by Governor Schwarzenegger." (AB 32 Scoping Plan at ES-13.) Thus, the state has made clear that California's emission reduction objectives will not be met solely through state regulation. Under the Scoping Plan, local governments are "essential partners in achieving California's goals to reduce greenhouse gas emissions." (Scoping Plan at 26.) Indeed, "[l]and use planning and urban growth decision," such as those contemplated by the Project are "areas where successful implementation of the Scoping Plan relies on local government." (*Id.* at 27; *see also* EPIC 2007 (identifying additional local measures in San Diego County needed to meet state emission reduction requirements for electricity sector).)

3. The EIR Has Not Demonstrated Consistency with CAT Strategies and Even if it Did, This is Not a Legitimate Means for Determining Significance

Absent any analysis, the EIR states "[m]itigation of global warming impacts is based on the project's consistency with the strategies proposed the California Environmental Protection Agency Climate Action Team's report. If the project is consistent with those strategies that the Lead Agency deems feasible, then a project could be deemed to have a less than significant impact on global climate change." (DEIR at 4.2-49.) The EIR's assertion that compliance with feasible measures identified in the Climate Action Team Report (CAT Report) does not withstand scrutiny. Not only does the EIR fail to demonstrate compliance with the CAT Report, but a lead agency may rely on a program or plan (such as the CAT Report) to make a less-than-significant determination regarding cumulative impacts only if the program or plan "provides specific requirements that will avoid or substantially lessen the cumulative problem" and is "specified in law or adopted by the public agency . . . through a public review process." Guidelines § 15064(h)(3). Because the CAT Report is only a general look at the types of measures state agencies could adopt to reduce greenhouse gas emissions and is not specified in law or adopted by the City or any other public agency, it meets none of these criteria. Consistent with Guideline § 15064(h)(3), OPR has specifically stated that "consistency with the Scoping Plan, by itself, is not a sufficient basis to determine that a project's emissions of greenhouse gases is not cumulatively considerable." (April 13, 2009 Letter from OPR to Resources Agency Re: Transmittal of the Governor's Office of Planning and Research's Proposed SB97 CEQA Guidelines Amendments to the Natural Resources Agency at 3.) As the CAT strategies contain measures even less finalized than that of the Scoping Plan, this reasoning applies with even greater force here.

4. Thresholds Proposed by Other Air Districts and Those Analyzed by CAPCOA Suggest Project Greenhouse Gas Impacts Are Significant

The EIR ignores significance guidance by air quality experts on how to determine the significance of greenhouse gas impacts under CEQA. Notably, none of the approaches used in the EIR are analyzed or recommended in air district guidance. In its CEQA and Climate Change White Paper, the California Air Pollution Control Officer's Association ("CAPCOA") analyzed a range of potential threshold. The only two thresholds that are highly effective at reducing emissions and highly consistent with AB 32 and Executive Order S-3-05 are a threshold of zero or a quantitative threshold designed to capture 90 percent or more of likely future discretionary projects (a 900-ton CO_2 Eq threshold).[9] A 40,000 – 50,000 ton project would have low consistency with AB 32 and Executive Order S-3-05. (Id.) After considerable analysis, the Bay Area Air Quality Management District has proposed a project-level threshold of 1,100 tons. (BAAQMD, Proposed Thresholds Nov. 2009). Here, even with its understated estimate, the Project would result in well over 500,000 tons of greenhouse gas emissions. As project emissions exceed proposed thresholds by orders of magnitude, project greenhouse gas impacts are clearly significant.

The failure to immediately and significantly reduce emissions from existing levels will result in devastating consequences for the economy, public health, natural resources, and the environment. Based on the scientific and factual data, thresholds that are not highly effective at reducing emissions are inadequate in the face of the profound threats posed by global warming. CEQA requires that a lead agency must "still consider any fair argument that a certain environmental effect may be significant" even where a project complies with a regulatory threshold. *Protect the Historic Amador Waterways v. Amador Water Agency*, 116 Cal. App. 4th 1099, 1109 (2004). Because there is overwhelming evidence that application of the EIR's threshold will still result in environmental effects, the EIR's less than significant determination does not withstand scrutiny.

The EIR's failure to recognize the cumulatively significant impacts from the project directly leads to the failure to consider feasible mitigation measures and alternatives to reduce this cumulatively significant impact. CEQA requires agencies to adopt feasible mitigation measures or feasible environmentally superior alternatives in order to substantially lessen or avoid the otherwise significant environmental impacts of a proposed project. Pub. Res. Code §§21002, 21081(a); CEQA Guidelines §§ 15002(a)(3), 15021(a)(2), 15091(a)(1). In the present case the EIR erroneously concludes, without substantial evidence, that the Project's improperly narrowed contribution of greenhouse gas emissions is not significant. Because it does not find the emissions significant, the EIR fails to require the adoption of feasible mitigation measures or alternatives.

II. DEIR Should Be Redrafted and Recirculated.

CEQA requires recirculation of a revised draft EIR "[w]hen significant new information is added to the environmental impact report" after public review and comment on the earlier draft DEIR. Pub. Res. Code § 21092.1. This includes the situation where, as here, "[t]he draft EIR was so fundamentally and basically inadequate

[9] CAPCOA, *CEQA & Climate Change* at 56-57 (Jan. 2008).

and conclusory in nature that meaningful public review and comment were precluded." Guidelines § 15088.5(b)(4). The opportunity for meaningful public review of significant new information is essential "to test, assess, and evaluate the data and make an informed judgment as to the validity of the conclusions to be drawn there from." *Sutter Sensible Planning, Inc. v. Sutter County Board of Supervisors*, 122 Cal.App.3d 813, 822 (1981); *City of San Jose v. Great Oaks Water Co.*, 192 Cal.App.3d 1005, 1017 (1987). An agency cannot simply release a draft report "that hedges on important environmental issues while deferring a more detailed analysis to the final [EIR] that is insulated from public review." *Mountain Lion Coalition v. California Fish and Game Comm'n*, 214 Cal.App.3d 1043, 1053 (1989).

In order to cure the panoply of defects identified in this letter, including the failure to recognize the significance of the Project's greenhouse gas emissions, the County will have to obtain substantial new information to adequately assess the proposed Project's environmental impacts, and to identify effective mitigation capable of alleviating the Project's significant impacts. CEQA requires that the public have a meaningful opportunity to review and comment upon this significant new information in the form of a recirculated draft EIR.

Thank you for considering these comments. If you have any questions, please contact Matt Vespa, mvespa@biologicaldiversity.org or (415) 436-9682 x309.

Please ensure that we are notified of any future action on this Project.

Sincerely,

Matthew Vespa
Senior Attorney

Enc: The following references are included in the accompanying CD for your review and inclusion in the administrative record.

ENCLOSED REFERENCES

Ex A Attorney General, Climate Change, CEQA & General Plans (March 2009)

Ex B BAAQMD, CEQA Guidelines Update, Proposed Thresholds of Significance (Nov. 2, 2009)

Ex C California Air Resources Board, Climate Change Scoping Plan (December 2008)

Ex D California Air Resources Board, Preliminary Draft Staff Proposal, Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under the CEQA, Oct. 24, 2008

Ex E CAPCOA, *CEQA & Climate Change* (Jan. 2008)

Ex F California Office of Planning and Research, Technical Advisory, CEQA and Climate Change: Addressing Climate Change through California Environmental Quality Act Review, June 17, 2008

Ex G California Natural Resources Agency, Initial Statement of Reasons for Regulatory Action, Proposed Amendments to the State CEQA Guidelines Addressing Analysis and Mitigation of Greenhouse Gas Emissions Pursuant to SB 97 (July 2009)

Ex H Cayan, et al. 2007. Our Changing Climate: Assessing the Risks to California. California Climate Change Center. Available at: http://www.climatechange.ca.gov/biennial_reports/2006report/index.html.

Ex I Energy Policy Initiatives Center (EPIC), Reducing Greenhouse Gases From Electricity and Natural Gas Use in San Diego County Buildings (2009)

Ex J S. Gupta et al., *Policies, Instruments and Co-operative Arrangements, in* CLIMATE CHANGE 2007: MITIGATION, CONTRIBUTION OF WORKING GROUP III TO THE FOURTH ASSESSMENT REPORT OF THE INTERNATIONAL PANEL ON CLIMATE CHANGE 776 (2007)

Ex K IPCC 2007, Summary for Policymakers, in Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (2007).

Ex L Office of Planning and Research (OPR), April 13, 2009 Letter from OPR to Resources Agency Re: Transmittal of the Governor's Office of Planning and Research's Proposed SB97 CEQA Guidelines Amendments to the Natural Resources Agency

Ex M SCAQMD, Draft Guidance Document – Interim CEQA Greenhouse Gas (GHG) Significance (Oct. 2008)

Ex N U.S. Global Change Research Program, GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES (2009)

Ex O Union of Concerned Scientists, How to Avoid Dangerous Climate Change: A Target for U.S. Emissions (2007)

Climate Change, the California Environmental Quality Act, and General Plan Updates: Straightforward Answers to Some Frequently Asked Questions
California Attorney General's Office

At any given time in this State, well over one hundred California cities and counties are updating their general plans. These are complex, comprehensive, long-term planning documents that can be years in the making. Their preparation requires local governments to balance diverse and sometimes competing interests and, at the same time, comply with the Planning and Zoning Law and the California Environmental Quality Act (CEQA).

Local governments have decades of experience in applying state planning law and excellent resources to assist them – such as the "General Plan Guidelines" issued by The Governor's Office of Planning and Research (OPR).[1] They are also practiced in assessing whether general plans may have significant localized environmental effects, such as degradation of air quality, reductions in the water supply, or growth inducing impacts. The impact of climate change, however, has only fairly recently shown up on the CEQA radar.

The fact that climate change presents a new challenge under CEQA has not stopped local governments from taking action. A substantial number of cities and counties already are addressing climate change in their general plan updates and accompanying CEQA documents. These agencies understand the substantial environmental and administrative benefits of a programmatic approach to climate change. Addressing the problem at the programmatic level allows local governments to consider the "big picture" and – provided it's done right – allows for the streamlined review of individual projects.[2]

Guidance addressing CEQA, climate change, and general planning is emerging, for example, in the pending CEQA Guideline amendments,[3] comments and settlements by the Attorney General, and in the public discourse, for example, the 2008 series on CEQA and Global Warming organized by the Local Government Commission and sponsored by the Attorney General. In addition, the Attorney General's staff has met informally with officials and planners from numerous jurisdictions to discuss CEQA requirements and to learn from those who are leading the fight against global warming at the local level.

Still, local governments and their planners have questions. In this document, we attempt to answer some of the most frequently asked of those questions. We hope this document will be useful, and we encourage cities and counties to contact us with any additional questions, concerns, or comments.

- **Can a lead agency find that a general plan update's climate change-related impacts are too speculative, and therefore avoid determining whether the project's impacts are significant?**

  No. There is nothing speculative about climate change. It's well understood that (1) greenhouse gas (GHG) emissions increase atmospheric concentrations of GHGs; (2) increased GHG concentrations in the atmosphere exacerbate global warming; (3) a project that adds to the atmospheric load of GHGs adds to the problem.

  Making the significance determination plays a critical role in the CEQA process.[4] Where a project may have a significant effect on the environment, the lead agency must prepare an Environmental Impact Report (EIR).[5] Moreover, a finding of significance triggers the obligation to consider alternatives and to impose feasible mitigation.[6] For any project under CEQA, including a general plan update, a lead agency therefore has a fundamental obligation to determine whether the environmental effects of the project, including the project's contribution to global warming, are significant.

- **In determining the significance of a general plan's climate change-related effects, must a lead agency estimate GHG emissions?**

  Yes. As OPR's Technical Advisory states:

  > Lead agencies should make a good-faith effort, based on available information, to calculate, model, or estimate the amount of CO2 and other GHG emissions from a project, including the emissions associated with vehicular traffic, energy consumption, water usage and construction activities.[7]

  In the context of a general plan update, relevant emissions include those from government operations, as well as from the local community as a whole. Emissions sources include, for example, transportation, industrial facilities and equipment, residential and commercial development, agriculture, and land conversion.

  There are a number of resources available to assist local agencies in estimating their current and projected GHG emissions. For example, the California Air Resources Board (ARB) recently issued protocols for estimating emissions from local government operations, and the agency's protocol for estimating community-wide emissions is forthcoming.[8] OPR's Technical Advisory contains a list of modeling tools to estimate GHG emissions. Other sources of helpful information include the white paper issued by the California Air Pollution Control Officers Association (CAPCOA), "CEQA and Climate Change"[9] and the Attorney General's website,[10] both of which provide information on currently available models for calculating emissions. In addition, many cities and counties are working with the International Council for Local Environmental Initiatives (ICLEI)[11] and tapping into the expertise of this State's many colleges and universities.[12]

- **For climate change, what are the relevant "existing environmental conditions"?**

  The CEQA Guidelines define a significant effect on the environment as "a substantial adverse change in the physical conditions which exist in the area affected by the proposed project."[13]

  For local or regional air pollutants, existing physical conditions are often described in terms of air quality (how much pollutant is in the ambient air averaged over a given period of time), which is fairly directly tied to current emission levels in the relevant "area affected." The "area affected," in turn, often is defined by natural features that hold or trap the pollutant until it escapes or breaks down. So, for example, for particulate matter, a lead agency may describe existing physical conditions by discussing annual average PM10 levels, and high PM10 levels averaged over a 24-hour period, detected at various points in the air basin in the preceding years.

  With GHGs, we're dealing with a global pollutant. The "area affected" is both the atmosphere and every place that is affected by climate change, including not just the area immediately around the project, but the region and the State (and indeed the planet). The existing "physical conditions" that we care about are the current atmospheric concentrations of GHGs and the existing climate that reflects those concentrations.

  Unlike more localized, ambient air pollutants which dissipate or break down over a relatively short period of time (hours, days or weeks), GHGs accumulate in the atmosphere, persisting for decades and in some cases millennia. The overwhelming scientific consensus is that in order to avoid disruptive and potentially catastrophic climate change, then it's not enough simply to stabilize our annual GHG emissions. The science tells us that we must <u>immediately and substantially reduce</u> these emissions.

- **If a lead agency agrees to comply with AB 32 regulations when they become operative (in 2012), can the agency determine that the GHG-related impacts of its general plan will be less than significant?**

  <u>No.</u> CEQA is not a mechanism merely to ensure compliance with other laws, and, in addition, it does not allow agencies to defer mitigation to a later date. CEQA requires lead agencies to consider the significant environmental effects of their actions and to mitigate them today, if feasible.

  The decisions that we make today do matter. Putting off the problem will only increase the costs of any solution. Moreover, delay may put a solution out of reach at any price. The experts tell us that the later we put off taking real action to reduce our GHG emissions, the less likely we will be able to stabilize atmospheric concentrations at a level that will avoid dangerous climate change.

- **Since climate change is a global phenomenon, how can a lead agency determine whether the GHG emissions associated with its general plan are significant?**

  The question for the lead agency is whether the GHG emissions from the project – the general plan update – are considerable when viewed in connection with the GHG emissions from past projects, other current projects, and probable future projects.[14] The effects of GHG emissions from past projects and from current projects to date are reflected in current atmospheric concentrations of GHGs and current climate, and the effects of future emissions of GHGs, whether from current projects or existing projects, can be predicted based on models showing future atmospheric GHG concentrations under different emissions scenarios, and different resulting climate effects.

  A single local agency can't, of course, solve the climate problem. But that agency can do its fair share, making sure that the GHG emissions from projects in its jurisdiction and subject to its general plan are on an emissions trajectory that, if adopted on a larger scale, is consistent with avoiding dangerous climate change.

  Governor Schwarzenegger's Executive Order S-3-05, which commits California to reducing its GHG emissions to 1990 levels by 2020 and to eighty percent below 1990 levels by 2050, is grounded in the science that tells us what we must do to achieve our long-term climate stabilization objective. The Global Warming Solutions Act of 2006 (AB 32), which codifies the 2020 target and tasks ARB with developing a plan to achieve this target, is a necessary step toward stabilization.[15] Accordingly, the targets set in AB 32 and Executive Order S-3-05 can inform the CEQA analysis .

  One reasonable option for the lead agency is to create community-wide GHG emissions targets for the years governed by the general plan. The community-wide targets should align with an emissions trajectory that reflects aggressive GHG mitigation in the near term and California's interim (2020) [16] and long-term (2050) GHG emissions limits set forth in AB 32 and the Executive Order.

  To illustrate, we can imagine a hypothetical city that has grown in a manner roughly proportional to the state and is updating its general plan through 2035. The city had emissions of 1,000,000 million metric tons (MMT) in 1990 and 1,150,000 MMT in 2008. The city could set an emission reduction target for 2014 of 1,075,000 MMT, for 2020 of 1,000,000 MMT, and for 2035 of 600,000 MMT, with appropriate emission benchmarks in between. Under these circumstances, the city could in its discretion determine that an alternative that achieves these targets would have less than significant climate change impacts.

- **Is a lead agency required to disclose and analyze the full development allowed under the general plan?**

  Yes. The lead agency must disclose and analyze the full extent of the development allowed by the proposed amended general plan,[17] including associated GHG emissions.

This doesn't mean that the lead agency shouldn't discuss the range of development that is likely to occur as a practical matter, noting, for example, the probable effect of market forces. But the lead agency can't rely on the fact that full build out may not occur, or that its timing is uncertain, to avoid its obligation to disclose the impacts of the development that the general plan would permit. Any other approach would seriously underestimate the potential impact of the general plan update and is inconsistent with CEQA's purposes.

- **What types of alternatives should the lead agency consider?**

  A city or county should, if feasible, evaluate at least one alternative that would ensure that the community contributes to a lower-carbon future. Such an alternative might include one or more of the following options:

  - higher density development that focuses growth within existing urban areas;
  - policies and programs to facilitate and increase biking, walking, and public transportation and reduce vehicle miles traveled;
  - the creation of "complete neighborhoods" where local services, schools, and parks are within walking distance of residences;
  - incentives for mixed-use development;
  - in rural communities, creation of regional service centers to reduce vehicle miles traveled;
  - energy efficiency and renewable energy financing (see, e.g., AB 811)[18]
  - policies for preservation of agricultural and forested land serving as carbon sinks;
  - requirements and ordinances that mandate energy and water conservation and green building practices; and
  - requirements for carbon and nitrogen-efficient agricultural practices.

  Each local government must use its own good judgment to select the suite of measures that best serves that community.

- **Can a lead agency rely on policies and measures that simply "encourage" GHG efficiency and emissions reductions?**

  No. Mitigation measures must be "fully enforceable."[19] Adequate mitigation does not, for example, merely "encourage" or "support" carpools and transit options, green building practices, and development in urban centers. While a menu of hortatory GHG policies is positive, it does not count as adequate mitigation because there is no certainty that the policies will be implemented.

  There are many concrete mitigation measures appropriate for inclusion in a general plan and EIR that can be enforced as conditions of approval or through ordinances. Examples are described in a variety of sources, including the CAPCOA's white paper,[20] OPR's Technical Advisory,[21] and the mitigation list on the Attorney General's website.[22] Lead agencies should also consider consulting with other cities and counties that have recently completed general plan updates or are working on Climate Action Plans.[23]

- **Is a "Climate Action Plan" reasonable mitigation?**

  Yes. To allow for streamlined review of subsequent individual projects, we recommend that the Climate Action Plan include the following elements: an emissions inventory (to assist in developing appropriate emission targets and mitigation measures); emission targets that apply at reasonable intervals through the life of the plan; enforceable GHG control measures; monitoring and reporting (to ensure that targets are met); and mechanisms to allow for the revision of the plan, if necessary, to stay on target.[24]

  If a city or county intends to rely on a Climate Action Plan as a centerpiece of its mitigation strategy, it should prepare the Climate Action Plan at the same time as its general plan update and EIR. This is consistent with CEQA's mandate that a lead agency must conduct environmental review at the earliest stages in the planning process and that it not defer mitigation. In addition, we strongly urge agencies to incorporate any Climate Action Plans into their general plans to ensure that their provisions are applied to every relevant project.

- **Is a lead agency also required to analyze how future climate change may affect development under the general plan?**

  Yes. CEQA requires a lead agency to consider the effects of bringing people and development into an area that may present hazards. The CEQA Guidelines note the very relevant example that "an EIR on a subdivision astride an active fault line should identify as a significant effect the seismic hazard to future occupants of the subdivision."[25]

  Lead agencies should disclose any areas governed by the general plan that may be particularly affected by global warming, e.g.: coastal areas that may be subject to increased erosion, sea level rise, or flooding; areas adjacent to forested lands that may be at increased risk from wildfire; or communities that may suffer public health impacts caused or exacerbated by projected extreme heat events and increased temperatures. General plan policies should reflect these risks and minimize the hazards for current and future development.

Endnotes

[1]For a discussion of requirements under general planning law, see OPR's General Plan Guidelines (2003). OPR is in the process of updating these Guidelines. For more information, visit OPR's website at http://www.opr.ca.gov/index.php?a=planning/gpg.html.

[2]OPR has noted the environmental and administrative advantages of addressing GHG emissions at the plan level, rather than leaving the analysis to be done project-by-project. See OPR, Preliminary Draft CEQA Guideline Amendments, Introduction at p. 2

(Jan. 8, 2009), available at http://opr.ca.gov/download.php?dl=Workshop_Announcement.pdf.

[3] OPR issued its Preliminary Draft CEQA Guidelines Amendments on January 8, 2009. Pursuant to Health and Safety Code, § 21083.05 (SB 97), OPR must prepare its final proposed guidelines by July 1, 2009, and the Resources Agency must certify and adopt those guidelines by January 1, 2010.

[4]Cal. Code Regs., tit. 14 (hereinafter "CEQA Guidelines"), § 15064, subd. (a).

[5]CEQA Guidelines, § 15064, subd. (f)(1).

[6]CEQA Guidelines, § 15021, subd. (a).

[7]OPR, CEQA and Climate Change: Addressing Climate Change Through California Environmental Quality Act (CEQA) Review (June 2008), available at http://opr.ca.gov/ceqa/pdfs/june08-ceqa.pdf.

[8] ARB's protocols for estimating the emissions from local government operations are available at http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm.

[9] CAPCOA, CEQA and Climate Change, Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act (January 2008) (hereinafter, "CAPCOA white paper"), available at http://www.capcoa.org/.

[10] http://ag.ca.gov/globalwarming/ceqa/modeling_tools.php

[11] http://www.iclei-usa.org

[12] For example, U.C. Davis has made its modeling tool, UPlan, available at http://ice.ucdavis.edu/doc/uplan; San Diego School of Law's Energy Policy Initiatives Center has prepared a GHG emissions inventory report for San Diego County http://www.sandiego.edu/EPIC/news/frontnews.php?id=31; and Cal Poly, San Luis Obispo City and Regional Planning Department is in the process of preparing a Climate Action Plan for the City of Benicia, see http://www.beniciaclimateactionplan.com/files/about.html.

[13]CEQA Guidelines, § 15002, subd. (g).

[14] CEQA Guidelines, § 15064(h)(1).

[15]See ARB, Scoping Plan at pp. 117-120, available at http://www.arb.ca.gov/cc/scopingplan/document/psp.pdf. (ARB approved the Proposed Scoping Plan on December 11, 2008.)

[16]In the Scoping Plan, ARB encourages local governments to adopt emissions reduction goals for 2020 "that parallel the State commitment to reduce greenhouse gas emissions by approximately 15 percent from current levels . . . ." Scoping Plan at p. 27; see *id.* at Appendix C, p. C-50. For the State, 15 percent below current levels is approximately equivalent to 1990 levels. *Id.* at p. ES-1. Where a city or county has grown roughly at

the same rate as the State, its own 1990 emissions may be an appropriate 2020 benchmark. Moreover, since AB 32's 2020 target represents the State's *maximum* GHG emissions for 2020 (see Health & Safety Code, § 38505, subd. (n)), and since the 2050 target will require substantial changes in our carbon efficiency, local governments may consider whether they can set an even more aggressive target for 2020. See Scoping Plan, Appendix C, p. C-50 [noting that local governments that "meet or exceed" the equivalent of a 15 percent reduction in GHG emissions by 2020 should be recognized].

[17] *Christward Ministry v. Superior Court* (1986) 184 Cal.App.3d 180, 194 [EIR must consider future development permitted by general plan amendment]; see also CEQA Guidelines, §§ 15126 [impact from all phases of the project], 15358, subd. (a) [direct and indirect impacts].

[18] See the City of Palm Desert's Energy Independence Loan Program at http://www.ab811.org.

[19] Pub. Res. Code, § 21081.6, subd. (b); CEQA Guidelines, § 15091, subd. (d); see also *Federation of Hillside and Canyon Assocs.* (2000) 83 Cal.App.4th 1252, 1261 [general plan EIR defective where there was no substantial evidence that mitigation measures would "actually be implemented"].

[20]CAPCOA white paper at pp. 79-87 and Appendix B-1.

[21]OPR Technical Advisory, Attachment 3.

[22]See http://ag.ca.gov/globalwarming/pdf/GW_mitigation_measures.pdf [mitigation list];http://ag.ca.gov/globalwarming/pdf/green_building.pdf [list of local green building ordinances].

[23]See http://opr.ca.gov/ceqa/pdfs/City_and_County_Plans_Addressing_Climate_Change.pdf.

[24]See Scoping Plan, Appendix C, at p. C-49.

[25]CEQA Guidelines, § 15126.2, subd. (a).



California Environmental Quality Act Guidelines Update

Proposed Thresholds of Significance

November 2, 2009

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Bay Area Air Quality Management District

Proposed Air Quality CEQA Thresholds of Significance

1 INTRODUCTION

Bay Area Air Quality Management District (BAAQMD or Air District) staff analyzed various options for California Environmental Quality Act (CEQA) air quality thresholds of significance for use within BAAQMD's jurisdiction. The analysis and evaluation undertaken by Air District staff is documented in the *Revised Draft Options and Justification Report – California Environmental Quality Act Thresholds of Significance* (Draft Options Report) (BAAQMD October 2009).

Air District staff hosted public workshops in February, April, September and October 2009 at several locations around the Bay Area. In addition, Air District staff met with regional stakeholder groups to discuss and receive input on the threshold options being evaluated. Throughout the course of the public workshops and stakeholder meetings Air District staff received many comments on the various options under consideration. Based on comments received and additional staff analysis, the threshold options and staff-recommended thresholds were further refined. The culmination of this year-long effort is presented in this Report as the Air District staff's proposed air quality thresholds of significance. The proposed thresholds presented herein are intended to replace all of the Air District's currently recommended thresholds. The proposed air quality thresholds of significance are provided in Table 1 at the end of this introduction.

1.1 BAAQMD/CEQA REGULATORY AUTHORITY

The BAAQMD has direct and indirect regulatory authority over sources of air pollution in the San Francisco Bay Area Air Basin (SFBAAB). CEQA requires that public agencies consider the potential adverse environmental impacts of any project that a public agency proposes to carry out, fund or approve. CEQA requires that a lead agency prepare an Environmental Impact Report (EIR) whenever it can be fairly argued (the "fair argument" standard), based on substantial evidence,[1] that a project may have a significant effect[2] on the environment, even if there is substantial evidence to the contrary (CEQA Guidelines §15064). CEQA requires that the lead agency review not only a project's direct effects on the environment, but also the cumulative impacts of a project and other projects causing related impacts. When the incremental effect of a project is cumulatively considerable,

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1 "Substantial evidence" includes facts, reasonable assumptions predicated upon facts, or expert opinions supported by facts, but does not include argument, speculation, unsubstantiated opinion or narrative, evidence that is clearly inaccurate or erroneous, or evidence of social or economic impacts that do not contribute to, or are not caused by, physical impacts on the environment. Cal. Pub. Res. C. §21080(c); *see also* CEQA Guidelines §15384.

2 A "significant effect" on the environment is defined as a "substantial, or potentially substantial, adverse change in the environment." Cal. Pub. Res. C. §21068; *see also* CEQA Guidelines §15382.

the lead agency must discuss the cumulative impacts in an EIR. (CEQA Guidelines §15064).

The "fair argument" standard refers to whether a fair argument can be made that a project may have a significant effect on the environment (*No Oil, Inc. v. City of Los Angeles* (1974) 13 Cal.3d 68, 84). The fair argument standard is generally considered a low threshold requirement for preparation of an EIR. The legal standards reflect a preference for requiring preparation of an EIR and for "resolving doubts in favor of environmental review." *Meija v. City of Los Angeles* (2005) 130 Cal. App. 4th 322, 332. "The determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved, based to the extent possible on scientific and factual data." (CEQA Guidelines §15064(b).

In determining whether a project may have a significant effect on the environment, CEQA Guidelines Section 15064.7 provides that lead agencies may adopt and/or apply "thresholds of significance." A threshold of significance is "an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant" (CEQA Guidelines §15064.7).

While thresholds of significance give rise to a presumption of insignificance, thresholds are not conclusive, and do not excuse a public agency of the duty to consider evidence that a significant effect may occur under the fair argument standard. *Meija*, 130 Cal. App. 4th at 342. "A public agency cannot apply a threshold of significance or regulatory standard 'in a way that forecloses the consideration of any other substantial evidence showing there may be a significant effect.'" *Id.* This means that if a public agency is presented with factual information or other substantial evidence establishing a fair argument that a project may have a significant effect on the environment, the agency must prepare an EIR to study those impacts even if the project's impacts fall below the applicable threshold of significance.

Thresholds of significance must be supported by substantial evidence. This Report provides the substantial evidence in support of the thresholds of significance developed by the BAAQMD. If adopted by the BAAQMD Board of Directors, the Air District will recommend that lead agencies within the nine counties of the BAAQMD's jurisdiction use the thresholds of significance in this Report when considering the air quality impacts of projects under their consideration.

1.2 JUSTIFICATION FOR UPDATING CEQA THRESHOLDS

Any analysis of environmental impacts under CEQA includes an assessment of the nature and extent of each impact expected to result from the project to determine whether the impact will be treated as significant or less than significant. CEQA gives lead agencies discretion whether to classify a particular environmental impact as significant. Ultimately, formulation of a standard of significance requires the lead agency to make a policy judgment about where the line should be drawn distinguishing adverse impacts it

considers significant from those that are not deemed significant. This judgment must, however, be based on scientific information and other factual data to the extent possible (CEQA Guidelines §15064(b)).

In the sense that advances in science provide new or refined factual data, combined with advances in technology and the gradual improvement or degradation of an environmental resource, the point where an environmental effect is considered significant is fluid over time. Other factors influencing this fluidity include new or revised regulations and standards, and emerging, new areas of concern.

In the ten years since BAAQMD last reviewed its recommended CEQA thresholds of significance for air quality, there have been tremendous changes that affect the quality and management of the air resources in the Bay Area. Traditional criteria air pollutant ambient air quality standards, at both the state and federal levels, have become increasingly more stringent. A new criteria air pollutant standard for $PM_{2.5}$ has been added to federal and state ambient air quality standards. We have found, through technical advances in impact assessment, that toxic air contaminants are not only worse than previously thought from a health perspective, but that certain communities experience high levels of toxic air contaminants, giving rise to new regulations and programs to reduce the significantly elevated levels of ambient toxic air contaminant concentrations in the Bay Area.

In response to the elevated levels of toxic air contaminants in some Bay Area communities, the Air District created the Community Air Risk Evaluation (CARE) Program. Phase 1 of the BAAQMD's CARE program compiled and analyzed a regional emissions inventory of toxic air contaminants (TACs), including emissions from stationary sources, area sources, and on-road and off-road mobile sources. Phase 2 of the CARE Program conducted regional computer modeling of selected TAC species, species which collectively posed the greatest risk to Bay Area residents. In both Phases 1 and 2 demographic data were combined with estimates of TAC emissions and concentrations to identify communities that are disproportionally impacted from high concentrations of TACs.

Another significant issue that affects the quality of life for Bay Area residents is the growing concern with global climate change. In just the past few years, estimates of the global atmospheric temperature and greenhouse gas concentration limits needed to stabilize climate change have been adjusted downward and the impacts of greenhouse gas emissions considered more dire. Previous scientific assessments assumed that limiting global temperature rise to 2-3°C above pre-industrial levels would stabilize greenhouse gas concentrations in the range of 450-550 parts per million (ppm) of carbon dioxide-equivalent (CO_2e). Now the science indicates that a temperature rise of 2°C would not prevent dangerous interference with the climate system. Recent scientific assessments suggest that global temperature rise should be kept below 2°C by stabilizing greenhouse gas concentrations below 350 ppm CO_2e, a significant reduction from the current level of 385 ppm CO_2e.

For the reasons stated above, and to further the goals of other District programs such as encouraging transit-oriented and infill development, BAAQMD has undertaken an effort to review all of its currently-recommended CEQA thresholds, revise them as appropriate, and develop new thresholds where appropriate. The overall goal of this effort is to develop CEQA significance criteria that ensure new development implements appropriate and feasible emission reduction measures to mitigate significant air quality impacts. The Air District's recommended CEQA significance thresholds have been vetted through a public review process and will be presented to the BAAQMD Board of Directors for adoption.

Table 1 – Proposed Air Quality CEQA Thresholds of Significance

Pollutant	**Construction-Related**	**Operational-Related**	
Project-Level			
Criteria Air Pollutants and Precursors (Regional)	**Average Daily Emissions (lb/day)**	**Average Daily Emissions (lb/day)**	**Maximum Annual Emissions (tpy)**
ROG	54	54	10
NO_X	54	54	10
PM_{10} (exhaust)	82	82	15
$PM_{2.5}$ (exhaust)	54	54	10
$PM_{10}/PM_{2.5}$ (fugitive dust)	Best Management Practices	None	
Local CO	None	9.0 ppm (8-hour average), 20.0 ppm (1-hour average)	
GHGs – Projects other than Stationary Sources	None	Compliance with Qualified Climate Action Plan OR 1,100 MT of CO_2e/yr OR 4.6 MT CO_2e/SP/yr (residents + employees)	
GHGs –Stationary Sources	None	10,000 MT/yr	
Risks and Hazards (Siting a New Source or Receptor)	Same as Operational Thresholds	Compliance with Qualified Risk Reduction Plan OR Increased cancer risk of >10.0 in a million Increased non-cancer risk of > 1.0 Hazard Index (Chronic or Acute) Ambient $PM_{2.5}$ increase: > 0.3 µg/m^3 annual average Zone of Influence: 1,000-foot radius from fence line of source or receptor	

Table 1 – Proposed Air Quality CEQA Thresholds of Significance		
Pollutant	**Construction-Related**	**Operational-Related**
Risks and Hazards (Cumulative – Source or Receptor)	Same as Operational Thresholds	Compliance with Qualified Risk Reduction Plan OR Cancer: > 100 in a million (from all local sources) Non-cancer: > 1.0 Hazard Index (from all local sources) (Chronic or Acute) $PM_{2.5}$: > 0.8 µg/m^3 annual average (from all local sources) Zone of Influence: 1,000-foot radius from fence line of source or receptor
Accidental Release of Acutely Hazardous Air Pollutants	None	Storage or use of acutely hazardous materials locating near receptors or receptors locating near stored or used acutely hazardous materials considered significant
Odors	None	Screening Level Distances and Complaint History
Plan-Level		
Criteria Air Pollutants and Precursors (Regional and Local)	1. Consistency with Current Air Quality Plan control measures 2. Projected VMT or vehicle trip increase is less than or equal to projected population increase	
GHGs	None	Compliance with Qualified Climate Action Plan (or similar criteria included in a General Plan) OR 6.6 MT CO2e/ SP/yr (residents + employees)
Risks and Hazards/Odors		1. Overlay zones around existing and planned sources of TACs (including adopted Risk Reduction Plan areas) and odors 2. Overlay zones of at least 500 feet (or Air District-approved modeled distance) from all freeways and high volume roadways
Accidental Release of Acutely Hazardous Air Pollutants	None	None

Notes: CEQA = California Environmental Quality Act; CO = carbon monoxide; CO_2e = carbon dioxide equivalent; GHGs = greenhouse gases; lb/day = pounds per day; MT = metric tons; NO_X = oxides of nitrogen; $PM_{2.5}$= fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less; PM_{10} = respirable particulate matter with an aerodynamic resistance diameter of 10 micrometers or less; ppm = parts per million; ROG = reactive organic gases; SO_2 = sulfur dioxide; SP = service population; TACs = toxic air contaminants; TBP = toxic best practices; tons/day = tons per day; tpy = tons per year; yr= year; TBD: to be determined.

2 GREENHOUSE GAS THRESHOLDS

BAAQMD does not currently have an adopted threshold of significance for GHG emissions. BAAQMD currently recommends that lead agencies quantify GHG emissions resulting from new development and apply all feasible mitigation measures to lessen the potentially adverse impacts. One of the primary objectives in updating the current CEQA Guidelines is to identify a GHG significance threshold, analytical methodologies, and mitigation measures to ensure new land use development meets its fair share of the emission reductions needed to address the cumulative environmental impact from GHG emissions. GHG emissions contribute, on a cumulative basis, to the significant adverse environmental impacts of global climate change. As reviewed herein, climate change impacts include an increase in extreme heat days, higher ambient concentrations of air pollutants, sea level rise, impacts to water supply and water quality, public health impacts, impacts to ecosystems, impacts to agriculture, and other environmental impacts. No single land use project could generate enough GHG emissions to noticeably change the global average temperature. The combination of GHG emissions from past, present, and future projects contribute substantially to the phenomenon of global climate change and its associated environmental impacts.

2.2 PROPOSED THRESHOLDS OF SIGNIFICANCE

Project Type	Proposed Thresholds
Land Use Projects	Compliance with Qualified Climate Action Plan OR 1,100 MT of CO_2e/yr OR 4.6 MT CO_2e/SP/yr* (residents + employees)
Stationary Sources	10,000 MT of CO_2e/yr
General Plans	Compliance with Qualified Climate Action Plan (or similar criteria included in a General Plan) OR 6.6 MT CO_2e/SP/yr (residents + employees)

* Staff notes that the efficiency-based thresholds should be applied to individual projects with caution. As explained herein, lead agencies may determine that the efficiency-based GHG thresholds for individual land use projects may not be appropriate for very large projects. If there is a fair argument that the project's emissions on a mass level will have a cumulatively considerable impact on the region's GHG emissions, the insignificance presumption afforded to a project that meets an efficiency-based GHG threshold would be overcome.

2.3 JUSTIFICATION AND SUBSTANTIAL EVIDENCE SUPPORTING THRESHOLDS

BAAQMD's approach to developing a threshold of significance for GHG emissions is to identify the emissions level for which a project would not be expected to substantially conflict with existing California legislation adopted to reduce statewide GHG emissions. If a project would generate GHG emissions above the threshold level, it would be

considered to contribute substantially to a cumulative impact, and would be considered significant. If mitigation can be applied to lessen the emissions such that the project meets its share of emission reductions needed to address the cumulative impact, the project would normally be considered less than significant.

As explained in the District's *Revised Draft Options and Justifications Report* (BAAQMD 2009), there are several types of thresholds that may be supported by substantial evidence and be consistent with existing California legislation and policy to reduce statewide GHG emissions. In determining which thresholds to recommend, Staff studied numerous options, relying on reasonable, environmentally conservative assumptions on growth in the land use sector, predicted emissions reductions from statewide regulatory measures and resulting emissions inventories, and the efficacies of GHG mitigation measures. The thresholds recommended herein were chosen based on the substantial evidence that such thresholds represent quantitative and/or qualitative levels of GHG emissions, compliance with which means that the environmental impact of the GHG emissions will normally not be cumulatively considerable under CEQA. Compliance with such thresholds will be part of the solution to the cumulative GHG emissions problem, rather than hinder the state's ability to meet its goals of reduced statewide GHG emissions. Staff notes that it does not believe there is only one threshold for GHG emissions that can be supported by substantial evidence.

GHG CEQA significance thresholds recommended herein are intended to serve as interim levels during the implementation of the AB 32 Scoping Plan and SB 375, which will occur over time. Until AB 32 has been fully implemented in terms of adopted regulations, incentives, and programs and until SB 375 required plans have been fully adopted, or ARB adopts a recommended threshold, the BAAQMD recommends that local agencies in the Bay Area apply the GHG thresholds recommended herein.

If left unchecked, GHG emissions from new land use development in California will result in a cumulatively considerable amount of GHG emissions and a substantial conflict with the State's ability to meet the goals within AB 32. Thus, BAAQMD prposes to adopt interim GHG thresholds for CEQA analysis, which can be used by lead agencies within the Bay Area. This would help lead agencies navigate this dynamic regulatory and technological environment where the field of analysis has remained wide open and inconsistent. BAAQMD's framework for developing a GHG threshold for land development projects that is based on policy and substantial evidence follows.

2.3.1 SCIENTIFIC AND REGULATORY JUSTIFICATION

Climate Science Overview

Prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, chlorofluorocarbons, and sulfur hexafluoride. Human-caused emissions of these GHGs in excess of natural ambient concentrations are responsible for intensifying the greenhouse effect and have led to a trend of unnatural warming of the earth's climate, known as global climate change or

global warming. It is *extremely unlikely* that global climate change of the past 50 years can be explained without the contribution from human activities (IPCC 2007a).

According to Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC), "Avoiding Dangerous Climate Change" means: *"stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."* Dangerous climate change defined in the UNFCCC is based on several key indicators including the potential for severe degradation of coral reef systems, disintegration of the West Antarctic Ice Sheet, and shut down of the large-scale, salinity- and thermally-driven circulation of the oceans. (UNFCCC 2009). The global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 ppm to 379 ppm in 2005 (IPCC 2007a). "Avoiding dangerous climate change" is generally understood to be achieved by stabilizing global average temperatures between 2 and 2.4°C above pre-industrial levels. In order to limit temperature increases to this level, ambient global CO_2 concentrations must stabilize between 350 and 400 ppm (IPCC 2007b).

Executive Order S-3-05

Executive Order S-3-05, which was signed by Governor Schwarzenegger in 2005, proclaims that California is vulnerable to the impacts of climate change. It declares that increased temperatures could reduce the Sierra's snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total GHG emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80 percent below the 1990 level by 2050.

Assembly Bill 32, the California Global Warming Solutions Act of 2006

In September 2006, Governor Arnold Schwarzenegger signed Assembly Bill 32, the California Global Warming Solutions Act of 2006, which set the 2020 greenhouse gas emissions reduction goal into law. AB 32 finds and declares that "Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California." AB 32 requires that statewide GHG emissions be reduced to 1990 levels by 2020, and establishes regulatory, reporting, voluntary, and market mechanisms to achieve quantifiable reductions in GHG emissions to meet the statewide goal.

In December of 2008, ARB adopted its *Climate Change Scoping Plan* (*Scoping Plan*), which is the State's plan to achieve GHG reductions in California, as required by AB 32 (ARB 2008). The Scoping Plan contains strategies California will implement to achieve a reduction of 169 MMT CO_2e emissions, or approximately 28 percent from the state's projected 2020 emission level of 596 MMT of CO_2e under a business-as-usual scenario (this is a reduction of 42 MMT of CO_2e, or almost 10 percent, from 2002-2004 average emissions), so that the state can return to 1990 emission levels, as required by AB 32.

While the Scoping Plan establishes the policy intent to control numerous GHG sources through regulatory, incentive, and market means, given the early phase of implementation

and the level of control that local CEQA lead agencies have over numerous GHG sources, CEQA is an important and supporting tool in achieving GHG reductions overall in compliance with AB 32. In this spirit, BAAQMD is considering the adoption of thresholds of significance for GHG emissions for stationary source and land use development projects.

Senate Bill 375

Senate Bill (SB) 375, signed in September 2008, aligns regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocation. SB 375 requires Metropolitan Planning Organizations (MPOs) to adopt a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS), which will prescribe land use allocation in that MPO's Regional Transportation Plan (RTP). ARB, in consultation with MPOs, will provide each affected region with reduction targets for GHGs emitted by passenger cars and light trucks in the region for the years 2020 and 2035. These reduction targets will be updated every eight years, but can be updated every four years if advancements in emission technologies affect the reduction strategies to achieve the targets. ARB is also charged with reviewing each MPO's SCS or APS for consistency with its assigned targets. If MPOs do not meet the GHG reduction targets, transportation projects would not be eligible for State funding programmed after January 1, 2012. New provisions of CEQA would incentivize qualified projects that are consistent with an approved SCS or APS, categorized as "transit priority projects."

While SB 375 is considered in the development of these thresholds, given that the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) development of the SCS for the Bay Area is in its early stages and the ARB GHG reduction target for light duty and passenger vehicles in the Bay Area has not yet been proposed, it is not appropriate from a CEQA perspective to expect SB 375 to completely address the emission reductions needed from this transportation sector in meeting AB 32 goals. In the future, as SB 375 implementation progresses, BAAQMD may need to revisit GHG thresholds.

2.3.2 PROJECT-LEVEL GHG THRESHOLDS

Staff recommends setting GHG significance thresholds based on AB 32 GHG emission reduction goals while taking into consideration emission reduction strategies outlined in ARB's Scoping Plan. Staff proposes two quantitative thresholds for land use projects: a bright line threshold based on a "gap" analysis and an efficiency threshold based on emission levels required to be met in order to achieve AB 32 goals.

Staff also proposes one qualitative threshold for land use projects: if a project complies with a Qualified Climate Action Plan (as defined in Section 2.3.4 below) that addresses the project or a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS) developed pursuant to SB 375 that addresses the project, it would be considered less than significant. As explained in detail in Section 2.3.4 below, compliance with a Qualified Climate Action Plan (or similar adopted policies, ordinances and programs), SCS or APS would provide the evidentiary basis for making CEQA

findings that development consistent with the plan would result in feasible, measureable, and verifiable GHG reductions consistent with broad state goals such that projects approved under qualified Climate Action Plans or equivalent demonstrations would achieve their fair share of GHG emission reductions.

2.3.2.1 LAND USE PROJECTS "GAP-BASED" THRESHOLD

Staff took eight steps in developing this threshold approach, which are summarized here and detailed in the sections that follow. It should be noted that the "gap-based approach" used for threshold development is a conservative approach that focuses on a limited set of state mandates that appear to have the greatest potential to reduce land use development-related GHG emissions at the time of this writing. It is also important to note that over time as the effectiveness of the State's implementation of AB 32 (and SB 375) progresses, BAAQMD will need to reconsider the extent of GHG reductions needed over and above those from the implementation thereof for the discretionary approval of land use development projects. Although there is an inherent amount of uncertainty in the estimated capture rates (i.e., frequency at which project-generated emissions would exceed a threshold and would be subject to mitigation under CEQA) and the aggregate emission reductions used in the gap analysis, they are based on BAAQMD's expertise, the best available data, and use conservative assumptions for the amount of emission reductions from legislation in derivation of the gap (e.g., only adopted legislation was relied upon). This approach is intended to attribute an appropriate share of GHG emission reductions necessary to reach AB 32 goals to new land use development projects in BAAQMD's jurisdiction that are evaluated pursuant to CEQA.

Step 1 Estimate from ARB's statewide GHG emissions inventory the growth in emissions between 1990 and 2020 attributable to "land use-driven" sectors of the emission inventory as defined by OPR's guidance document (*CEQA and Climate Change*). Land use-driven emission sectors include Transportation (On-Road Passenger Vehicles; On-Road Heavy Duty), Electric Power (Electricity; Cogeneration), Commercial and Residential (Residential Fuel Use; Commercial Fuel Use) and Recycling and Waste (Domestic Waste Water Treatment).

Result: 1990 GHG emissions were 295.53 MMT CO_2e/yr and projected 2020 business-as-usual GHG emissions would be 400.22 MMT CO_2e/yr; thus a 26.2 percent reduction from statewide land use-driven GHG emissions would be necessary to meet the AB 32 goal of returning to 1990 emission levels by 2020. (See Table 2)

Step 2 Estimate the anticipated GHG emission reductions affecting the same land use-driven emissions inventory sectors associated with adopted statewide regulations identified in the AB 32 Scoping Plan.

Result: Estimated a 23.9 percent reduction can be expected in the land use-driven GHG emissions inventory from adopted Scoping Plan regulations, including AB 1493 (Pavley), LCFS, Heavy/Medium Duty Efficiency, Passenger Vehicle Efficiency, Energy-Efficiency

Measures, Renewable Portfolio Standard, and Solar Roofs. (See Table 3)

Step 3 Determine any short fall or "gap" between the 2020 statewide emission inventory estimates and the anticipated emission reductions from adopted Scoping Plan regulations. This "gap" represents additional GHG emission reductions needed statewide from the land use-driven emissions inventory sectors, which represents new land use development's share of the emission reductions needed to meet statewide GHG emission reduction goals.

Result: With the 23.9 percent reductions from AB 32 Scoping Measures, there is a "gap" of 2.3 percent in necessary additional GHG emissions reductions to meet AB 32 goals of a 26.2 percent reduction from statewide land use-driven GHG emissions to return to 1990 levels in 2020. (See Table 2)

Step 4 Determine the percent reduction this "gap" represents in the "land use-driven" emissions inventory sectors from BAAQMD's 2020 GHG emissions inventory. Identify the mass of emission reductions needed in the SFBAAB from land use-driven emissions inventory sectors.

Result: Estimated that a 2.3 percent reduction in BAAQMD's projected 2020 emissions projections requires emissions reductions of 1.6 MMT CO_2e/yr from the land use-driven sectors. (See Table 4)

Step 5 Assess BAAQMD's historical CEQA database (2001-2008) to determine the frequency distribution trend of project sizes and types that have been subject to CEQA over the past several years.

Result: Determined historical patterns of residential, commercial and industrial development by ranges of average sizes of each development type. Results were used in Step 6 below to distribute anticipated Bay Area growth among different future project types and sizes.

Step 6 Forecast new land use development for the Bay Area using DOF/EDD population and employment projections and distribute the anticipated growth into appropriate land use types and sizes needed to accommodate the anticipated growth (based on the trend analysis in Step 5 above). Translate the land use development projections into land use categories consistent with those contained in the Urban Emissions Model (URBEMIS).

Result: Based on population and employment projections and the trend analysis from Step 5 above, forecasted approximately 4,000 new development projects, averaging about 400 projects per year through 2020 in the Bay Area.

Step 7 Estimate the amount of GHG emissions from each land use development project type and size using URBEMIS and post-model manual calculation methods (for emissions not included in URBEMIS. Determine the amount of GHG emissions that can reasonably and feasibly be reduced through currently available mitigation measures ("mitigation effectiveness") for future land use development projects subject to CEQA (based on land use development projections and frequency distribution from Step 6 above).

Result: Based on the information available and on sample URBEMIS calculations, found that mitigation effectiveness of between 25 and 30 percent is feasible.

Step 8 Conduct a sensitivity analysis of the numeric GHG mass emissions threshold needed to achieve the desired emissions reduction (i.e., "gap") determined in Step 4. This mass emission GHG threshold is that which would be needed to achieve the emission reductions necessary by 2020 to meet the Bay Area's share of the statewide "gap" needed from the land use-driven emissions inventory sectors.

Result: The results of the sensitivity analysis conducted in Step 8 found that reductions between about 125,000 MT/yr (an aggregate of 1.3 MMT in 2020) and over 200,000 MT/yr (an aggregate of over 2.0 MMT in 2020) were achievable and feasible. A mass emissions threshold of 1,100 MT of CO_2e/yr would result in approximately 59 percent of all projects being above the significance threshold (e.g., this is approximately the operational GHG emissions that would be associated with a 60 residential unit subdivision) and must implement feasible mitigation measures to meet CEQA requirements. With estimated 26 percent mitigation effectiveness, the 1,100 MT threshold would achieve 1.6 MMT CO_2e/yr in GHG emissions reductions.

2.3.2.2 DETAILED BASIS AND ANALYSIS

Derivation of Greenhouse Gas Reduction Goal

To meet the target emissions limit established in AB 32 (equivalent to levels in 1990), total GHG emissions would need to be reduced by approximately 28 percent from projected 2020 forecasts (ARB 2009a). The AB 32 Scoping Plan is ARB's plan for meeting this mandate (ARB 2008). While the Scoping Plan does not specifically identify GHG emission reductions from the CEQA process for meeting AB 32 derived emission limits, the scoping plan acknowledges that "other strategies to mitigate climate change . . . should also be explored." The Scoping Plan also acknowledges that "Some of the measures in the plan may deliver more emission reductions than we expect; others less . . . and new ideas and strategies will emerge." In addition, climate change is considered a significant environmental issue and, therefore, warrants consideration under CEQA. SB 97 represents the State Legislature's confirmation of this fact, and it directed the Governor's Office of Planning and Research (OPR) to develop CEQA Guidelines for

evaluation of GHG emissions impacts and recommend mitigation strategies. In response, OPR released the *Technical Advisory: CEQA and Climate Change* (OPR 2008), and has released proposed CEQA guidelines (April 14, 2009) for consideration of GHG emissions. It is known that new land use development must also do its fair share toward achieving AB 32 goals (or, at a minimum, should not hinder the State's progress toward the mandated emission reductions).

Foreseeable Scoping Plan Measures Emission Reductions and Remaining "Gap"

Step 1 of the Gap Analysis entailed estimating from ARB's statewide GHG inventory the growth in emissions between 1990 and 2020 attributable to land use driven sectors of the emissions inventory. As stated above, to meet the requirements set forth in AB 32 (i.e., achieve California's 1990-equivalent GHG emissions levels by 2020) California would need to achieve an approximate 28 percent reduction in emissions across all sectors of the GHG emissions inventory compared with 2020 projections. However, to meet the AB 32 reduction goals in the emissions sectors that are related to land use development (e.g., on-road passenger and heavy-duty motor vehicles, commercial and residential area sources [i.e., natural gas], electricity generation/consumption, wastewater treatment, and water distribution/consumption), staff determined that California would need to achieve an approximate 26 percent reduction in GHG emissions from these land use-driven sectors (ARB 2009a) by 2020 to return to 1990 land use emission levels.

Next, in Step 2 of the Gap Analysis, Staff determined the GHG emission reductions within the land use-driven sectors that are anticipated to occur from implementation of the Scoping Plan measures statewide, which are summarized in Table 2 and described below. Since the GHG emission reductions anticipated with the Scoping Plan were not accounted for in ARB's or BAAQMD's 2020 GHG emissions inventory forecasts (i.e., business as usual), an adjustment was made to include (i.e., give credit for) GHG emission reductions associated with key Scoping Plans measures, such as the Renewable Portfolio Standard, improvements in energy efficiency through periodic updates to Title 24, AB 1493 (Pavley) (which recently received a federal waiver to allow it to be enacted in law), the Low Carbon Fuel Standard (LCFS), and other measures. With reductions from these State regulations (Scoping Plan measures) taken into consideration and accounting for an estimated 23.9% reduction in GHG emissions, in Step 3 of the Gap Analysis Staff determined that the Bay Area would still need to achieve an additional 2.3 percent reduction from projected 2020 GHG emissions to meet the 1990 GHG emissions goal from the land-use driven sectors. This necessary 2.3 percent reduction in projected GHG emissions from the land use sector is the "gap" the Bay Area needs to fill to do its share to meet the AB 32 goals. Refer to the following explanation and Tables 2 through 4 for data used in this analysis.

Because the transportation sector is the largest emissions sector of the state's GHG emissions inventory, it is aggressively targeted in early actions and other priority actions in the Scoping Plan including measures concerning gas mileage (Pavley), fuel carbon intensity (LCFS) and vehicle efficiency measures.

Table 2 – California 1990, 2002-2004, and 2020 Land Use Sector GHG[1] ($MMT CO_2e/yr$)				
Sector	**1990 Emissions**	**2002-2004 Average**	**2020 BAU Emissions Projections**	**% of 2020 Total**
Transportation	**137.98**	**168.66**	**209.06**	**52%**
On-Road Passenger Vehicles	108.95	133.95	160.78	40%
On-Road Heavy Duty	29.03	34.69	48.28	12%
Electric Power	**110.63**	**110.04**	**140.24**	**35%**
Electricity	95.39	88.97	107.40	27%
Cogeneration[2]	15.24	21.07	32.84	8%
Commercial and Residential	**44.09**	**40.96**	**46.79**	**12%**
Residential Fuel Use	29.66	28.52	32.10	8%
Commercial Fuel Use	14.43	12.45	14.63	4%
Recycling and Waste[1]	**2.83**	**3.39**	**4.19**	**1%**
Domestic Wastewater Treatment	2.83	3.39	4.19	1%
TOTAL GROSS EMISSIONS	**295.53**	**323.05**	**400.22**	
% Reduction Goal from Statewide land use driven sectors (from 2020 levels to reach 1990 levels in these emission inventory sectors)			26.2%	
% Reduction from AB32 Scoping Plan measures applied to land use sectors (see Table 3)			-23.9%	
% Reduction needed statewide beyond Scoping Plan measures (Gap)			2.3%	

Notes: MMT CO_2e /yr = million metric tons of carbon dioxide equivalent emissions per year.
[1] Landfills not included. See text.
[2] Cogeneration included due to many different applications for electricity, in some cases provides substantial power for grid use, and because electricity use served by cogeneration is often amenable to efficiency requirements of local land use authorities.
Sources: Data compiled by EDAW and ICF Jones & Stokes from ARB data.

Pavley Regulations. The AB 32 Scoping Plan assigns an approximate 20 percent reduction in emissions from passenger vehicles associated with the implementation of AB 1493. The AB 32 Scoping Plan also notes that "AB 32 specifically states that if the Pavley regulations do not remain in effect, ARB shall implement alternative regulations to control mobile sources to achieve equivalent or greater reductions of greenhouse gas emissions (HSC §38590)." Thus, it is reasonable to assume full implementation of AB 1493 standards, or equivalent programs that would be implemented by ARB. While the Obama administration has proposed national CAFE standards that may be equivalent to or even surpass AB 1493, the timing for implementation of the proposed federal standards is uncertain such that development of thresholds based on currently unadopted federal standards would be premature. BAAQMD may need to revisit this methodology as the federal standards come on line, particularly if such standards are more aggressive than that forecast under state law.

Table 3 – 2020 Land Use Sector GHG Emission Reductions from State Regulations and AB 32 Measures

Affected Emissions Source	California Legislation	% Reduction from 2020 GHG inventory	End Use Sector (% of Bay Area LU Inventory)	Scaled % Emissions Reduction (credit)
Mobile	AB 1493 (Pavley)	19.7%	On road passenger/light truck transportation (45%)	8.9%
	LCFS	7.2%	On road passenger/light truck transportation (45%)	3.2%
	LCFS	7.2%	On road Heavy/Medium Duty Transportation (5%)	0.4%
	Heavy/Medium Duty Efficiency	2.9%	On road Heavy/Medium Duty Transportation (5%)	0.2%
	Passenger Vehicle Efficiency	2.8%	On road passenger/light truck transportation (45%)	1.3%
Area	Energy-Efficiency Measures	9.5%	Natural gas (Residential, 10%)	1.0%
			Natural gas (Non-residential,13%)	1.2%
Indirect	Renewable Portfolio Standard	21.0%	Electricity (excluding cogen) (17%)	3.5%
	Energy-Efficiency Measures	15.7%	Electricity (26%)	4.0%
	Solar Roofs	1.5%	Electricity (excluding cogen) (17%)	0.2%
Total credits given to land use-driven emission inventory sectors from Scoping Plan measures				**23.9%**

Notes: AB = Assembly Bill; LCFS = Low Carbon Fuel Standard; SB = Senate Bill; RPS = Renewable Portfolio Standard
Please refer to Appendix D for detailed calculations. Sources: Data compiled by ICF Jones & Stokes.

LCFS. According to the adopted LCFS rule (CARB, April 2009), the LCFS is expected to result in approximately 10 percent reduction in the carbon intensity of transportation fuels. However, a portion of the emission reductions required from the LCFS would be achieved over the life cycle of transportation fuel production rather than from mobile-source emission factors. Based on CARB's estimate of nearly 16 MMT reductions in on-road emissions from implementation of the LCFS and comparison to the statewide on-road emissions sector, the LCFS is assumed to result in a 7.2 percent reduction compared to 2020 BAU conditions (CARB 2009e).

Table 4 – SFBAAB 1990, 2007, and 2020 Land Use Sector GHG Emissions Inventories and Projections (MMT CO_2e/yr)				
Sector	**1990 Emissions**	**2007 Emissions**	**2020 Emissions Projections**	**% of 2020 Total[2]**
Transportation	**26.1**	**30.8**	**35.7**	**50%**
On-Road Passenger Vehicles	23.0	27.5	32.0	
On-Road Heavy Duty	3.1	3.3	3.7	
Electric Power	**25.1**	**15.2**	**18.2**	**26%**
Electricity	16.5	9.9	11.8	
Cogeneration	8.6	5.3	6.4	
Commercial and Residential	**8.9**	**15.0**	**16.8**	**24%**
Residential Fuel Use	5.8	7.0	7.5	
Commercial Fuel Use	3.1	8.0	9.3	
Recycling and Waste[1]	**0.2**	**0.4**	**0.4**	**1%**
Domestic Waste Water Treatment	0.2	0.4	0.4	
TOTAL GROSS EMISSIONS	**60.3**	**61.4**	**71.1**	
SFBAAB's "Fair Share" % Reduction (from 2020 levels to reach 1990 levels) with AB-32 Reductions (from Table 3)			2.3%	
SFBAAB's Equivalent Mass Emissions Land Use Reduction Target at 2020 (MMT CO2e/yr)			1.6	

Notes: MMT CO_2e /yr = million metric tons of carbon dioxide equivalent emissions per year; SFBAAB = San Francisco Bay Area Air Basin.
[1] Landfills not included.
[2] Percentages do not sum exactly to 100% in table due to rounding.
Please refer to Appendix D for detailed calculations.
Sources: Data compiled by EDAW 2009, ICF Jones & Stokes 2009, BAAQMD 2008.

Renewable Portfolio Standard, Energy Efficiency and Solar Roofs. Energy efficiency and renewable energy measures from the Scoping Plan were also included in the gap analysis. The Renewable Portfolio Standard (rules) will require the renewable energy portion of the retail electricity portfolio to be 33 percent in 2020. For PG&E, the dominant electricity provider in the Basin, approximately 12 percent of their current portfolio qualifies under the RPS rules and thus the gain by 2020 would be approximately 21 percent. The Scoping Plan also estimates that energy efficiency gains with periodic improvement in building and appliance energy standards and incentives will reach 10 to 15 percent for natural gas and electricity respectively. The final state measure included in this gap analysis is the solar roof initiative, which is estimated to result in reduction of the overall electricity inventory of 1.5 percent.

Landfill emissions are excluded from this analysis. While land use development does generate waste related to both construction and operations, CIWMB has mandatory diversion requirements that will, in all probability, increase over time to promote waste reductions, reuse, and recycle. The Bay Area has relatively high levels of waste diversion and extensive recycling efforts. Further, ARB has established and proposes to increase methane capture requirements for all major landfills. Thus, at this time, landfill emissions

associated with land use development waste generation is not included in the land use sector inventory used to develop this threshold approach.

Industrial stationary sources thresholds were developed separately from the land use threshold development using a market capture approach as described below. However, mobile source and area source emissions, as well as indirect electricity emissions that derive from industrial use are included in the land use inventory above as these particular activities fall within the influence of local land use authorities in terms of the affect on trip generation and energy efficiency.

AB 32 mandates reduction to 1990-equivalent GHG levels by 2020, with foreseeable emission reductions from State regulations and key Scoping Plan measures taken into account, were applied to the land use-driven emission sectors within the SFBAAB (i.e., those that are included in the quantification of emissions from a land use project pursuant to a CEQA analysis [on-road passenger vehicles, commercial and residential natural gas, commercial and residential electricity consumption, and domestic waste water treatment], as directed by OPR in the Technical Advisory: *Climate Change and CEQA* [OPR 2008]). This translates to a 2.3 percent gap in necessary GHG emission reductions by 2020 from these sectors.

2.3.2.3 LAND USE PROJECTS BRIGHT LINE THRESHOLD

In Steps 4 and 5 of the gap analysis, Staff determined that applying a 2.3 percent reduction to these land use emissions sectors in the SFBAAB's GHG emissions inventory would result in an equivalent fair share of 1.6 million metric tons per year (MMT/yr) reductions in GHG emissions from new land use development. As additional regulations and legislation aimed at reducing GHG emissions from land use-related sectors become available in the future, the 1.6 MMT GHG emissions reduction goal may be revisited and recalculated by BAAQMD.

In order to derive the 1.6 MMT "gap," a projected development inventory for the next ten years in the SFBAAB was calculated. (See Table 4 and *Revised Draft Options and Justifications Report* (BAAQMD 2009).) CO_2e emissions were modeled for projected development in the SFBAAB and compiled to estimate the associated GHG emissions inventory. The GHG (i.e., CO_2e) CEQA threshold level was adjusted for projected land use development that would occur within BAAQMD's jurisdiction over the period from 2010 through 2020.

Projects with emissions greater than the threshold would be required to mitigate to the threshold level or reduce project emissions by a percentage (mitigation effectiveness) deemed feasible by the Lead Agency under CEQA compared to a base year condition. The base year condition is defined by an equivalent size and character of project with annual emissions using the defaults in URBEMIS and the California Climate Action Registry's General Reporting Protocol for 2008. By this method, land use project mitigation subject to CEQA would help close the "gap" remaining after application of the key regulations and measures noted above supporting overall AB 32 goals.

This threshold takes into account Steps 1-8 of the gap analysis described above to arrive at a numerical mass emissions threshold. Various mass emissions significance threshold levels (i.e., bright lines) could be chosen based on the mitigation effectiveness and performance anticipated to be achieved per project to meet the aggregate emission reductions of 1.6 MMT needed in the SFBAAB by 2020. (See Table 5 and *Revised Draft Options and Justifications Report* (BAAQMD 2009).) Staff recommends a 1,100 MT CO_2e per year threshold. Choosing a 1,100 MT mass emissions (equivalent to approximately 60 single-family units), significance threshold level would result in about 59 percent of all projects being above the significance threshold and having to implement feasible mitigation measures to meet their CEQA obligations. These projects account for approximately 92 percent of all GHG emissions anticipated to occur between now and 2020 from new land use development in the SFBAAB.

Project applicants and lead agencies could use readily available computer models to estimate a project's GHG emissions, based on project specific attributes, to determine if they are above or below the bright line numeric threshold. With this threshold, projects that are above the threshold level would have to reduce their emissions to below the threshold to be considered less than significant.

Establishing a "bright line" to determine the significance of a project's GHG emission impact provides a level of certainty to lead agencies in determining if a project needs to reduce its GHG emissions through mitigation measures and when an EIR is required.

Table 5 – Operational GHG Threshold Sensitivity Analysis

Option	Mitigation Effectiveness Assumptions		Mass Emission Threshold Level (MT CO_2e/yr)	% of Projects Captured (>threshold)	% of Emissions Captured (> threshold)	Emissions Reduction per year (MT/yr)	Aggregate Emissions Reduction (MMT) at 2020	Threshold Project Size Equivalent (single family dwelling units)
	Performance Standards Applied to All Projects with Emissions < Threshold Level	Mitigation Effectiveness Applied to Emissions > Threshold Level						
1A	N/A	30%	975	60%	93%	201,664	2.0	53
1A	N/A	25%	110	96%	100%	200,108	2.0	66
1A	N/A	30%	1,225	21%	67%	159,276	1.6	67
1A	N/A	26%	1,100	59%	92%	159,877	1.6	60
1A	N/A	30%	2,000	14%	61%	143,418	1.4	109
1A	N/A	25%	1,200	58%	92%	136,907	1.4	66
1A	N/A	30%	3,000	10%	56%	127,427	1.3	164
1A	N/A	25%	1,500	20%	67%	127,303	1.3	82
1B	26%	N/A	N/A	100%	100%	208,594	2.1	N/A[1]
1C	5%	30%	1,900	15%	62%	160,073	1.6	104
1C	10%	25%	1,250	21%	67%	159,555	1.6	68
1C	5%	30%	3,000	10%	56%	145,261	1.5	164
1C	10%	25%	2,000	4%	61%	151,410	1.5	109
1C	10%	30%	10,000	2%	33%	125,271	1.3	547

Notes: MMT = million metric tons per year; MT CO_2e/yr = metric tons of carbon dioxide equivalent emissions per year; MT/yr = metric tons per year; N/A = not applicable.

[1] Any project subject to CEQA would trigger this threshold.

Please refer to Appendix E for detailed calculations.

Source: Data modeled by ICF Jones & Stokes.

2.3.2.4 LAND USE PROJECTS EFFICIENCY-BASED THRESHOLD

GHG efficiency metrics can also be utilized as thresholds to assess the GHG efficiency of a project on a per capita basis (residential only projects) or on a "service population" basis (the sum of the number of jobs and the number of residents provided by a project) such that the project will allow for consistency with the goals of AB 32 (i.e., 1990 GHG emissions levels by 2020). GHG efficiency thresholds can be determined by dividing the GHG emissions inventory goal (allowable emissions), by the estimated 2020 population and employment. This method allows highly efficient projects with higher mass emissions to meet the overall reduction goals of AB 32. Staff believes it is more appropriate to base the land use efficiency threshold on the service population metric for the land use-driven emission inventory. This approach is appropriate because the threshold can be applied evenly to all project types (residential or commercial/retail only and mixed use) and uses only the land use emissions inventory that is comprised of all land use projects. Staff will provide the methodology to calculate a project's GHG emissions in the revised CEQA Guidelines, such as allowing infill projects up to a 50 percent reduction in daily vehicle trips if the reduction can be supported by close proximity to transit and support services or a traffic study prepared for the project.

Table 6 – California 2020 GHG Emissions, Population Projections and GHG Efficiency Thresholds - Land Use Inventory Sectors

Land Use Sectors Greenhouse Gas Emissions Target	295,530,000
Population	44,135,923
Employment	20,194,661
California Service Population (Population + Employment)	64,330,584
AB 32 Goal GHG emissions (metric tons CO_2e)/SP[1]	**4.6**

Notes: AB = Assembly Bill; CO_2e = carbon dioxide equivalent; GHG = greenhouse gas; SP = service population.
[1] Greenhouse gas efficiency levels were calculated using only the "land use-related" sectors of ARB's emissions inventory.
Please refer to Appendix D for detailed calculations.
Sources: Data compiled by EDAW 2009, ARB 2009a, DOF 2009, EDD 2009, ICF Jones & Stokes 2009.

Staff proposes a project-level efficiency threshold of 4.6 MT CO_2e/SP, the derivation of which is shown Table 6. This efficiency-based threshold reflects very GHG-efficient projects. As stated previously and below, staff anticipates that significance thresholds (rebuttable presumptions of significance at the project level) will function on an interim basis only until adequate programmatic approaches are in place at the city, county, and regional level that will allow the CEQA streamlining of individual projects. (See Draft CEQA Guidelines, proposed section 15183.5 ["Tiering and Streamlining the Analysis of Greenhouse Gas Emissions"]). In advance of such programmatic approaches, local agencies may wish to apply this efficiency-based recommended threshold with some discretion, taking into account not only the project's efficiency, but also its total GHG emissions. Even where a project is relatively GHG-efficient as compared to other projects, in approving the project, the lead agency is committing to use what is essentially

its GHG "budget" in a given way. Expending this "budget" on the proposed project may affect other development opportunities and associated obligations to mitigate or conflict with other actions that the community may wish to take to reduce its overall GHG emissions after it has conducted its programmatic analysis.

Accordingly, in applying the efficiency-based threshold of 4.6 MT CO_2e/SP, the lead agency might also wish to consider the project's total emissions. Where a project meets the efficiency threshold but would still have very large GHG emissions, the lead agency may wish to consider whether the project's contributions to climate change might still be cumulatively considerable and whether additional changes to the project or mitigation should be required. Staff notes that even where the project may be significant as it relates to climate change, the lead agency may find that the project should nonetheless be approved in light of its benefits; in that case, the lead agency may wish to note the project's efficiency and any innovative design features in the Statement of Overriding Considerations.

2.3.3 PLAN-LEVEL GHG THRESHOLDS

Staff proposes using a two step process for determining the significance of proposed plans and plan amendments for GHG. As discussed above for project-level GHG impacts, Staff is proposing an efficiency threshold to assess plan-level impacts. In addition, as a first step in assessing plan-level impacts, Staff is proposing that agencies that have adopted a qualified climate action plan (or have incorporated similar criteria in their General Plan) and the General Plan or Transportation Plan are consistent with the climate action plan, the General Plan or Transportation Plan would be considered less than significant. Staff believes a programmatic approach to limiting GHG emissions is appropriate at the plan-level. Thus, as projects consistent with the climate action plan are proposed, they may be able to tier off the plan and its environmental analysis.

2.3.3.1 GHG EFFICIENCY METRICS FOR PLANS

For local land use plans, a GHG-efficiency metric (e.g., GHG emissions per unit) would enable comparison of a proposed general plan to its alternatives and to determine if the proposed general plan meets AB 32 emission reduction goals.

AB 32 identifies local governments as essential partners in achieving California's goal to reduce GHG emissions. Local governments have primary authority to plan, zone, approve, and permit how and where land is developed to accommodate population growth and the changing needs of their jurisdiction. ARB has developed the Local Government Operations Protocol and is developing a protocol to estimate community-wide GHG emissions. ARB encourages local governments to use these protocols to track progress in reducing GHG emissions. ARB encourages local governments to institutionalize the community's strategy for reducing its carbon footprint in its general plan. SB 375 creates a process for regional integration of land development patterns and transportation infrastructure planning with the primary goal of reducing GHG emissions from the largest sector of the GHG emission inventory, light duty vehicles.

If the statewide AB 32 GHG emissions reduction context is established, GHG efficiency can be viewed independently from the jurisdiction in which the plan is located. Expressing projected 2020 mass of emissions from land use-related emissions sectors by comparison to a demographic unit (e.g., population and employment) provides evaluation of the GHG efficiency of a project in terms of what emissions are allowable while meeting AB 32 targets.

Two approaches were considered for efficiency metrics. The "service population" (SP) approach would consider efficiency in terms of the GHG emissions compared to the sum of the number of jobs and the number of residents at a point in time. The per capita option would consider efficiency in terms of GHG emissions per resident only. Staff recommends that the efficiency threshold for plans be based on all emission inventory sectors because, unlike land use projects, community-wide or regional plans comprise more than just land use related emissions (e.g. industrial). Further, Staff recommends that plan threshold be based on the service population metric as community-wide plans or regional plans include a mix of residents and employees. The Service Population metric would allow decision makers to compare GHG efficiency of general plan alternatives that vary residential and non-residential development totals, encouraging GHG efficiency through improving jobs/housing balance. This approach would not give preference to communities that accommodate more residential (population-driven) land uses than non-residential (employment driven) land uses which could occur with the per capita approach.

A SP-based GHG efficiency metric was (see Table 7) for the emissions rates at the State level that would accommodate projected growth (as indicated by population and employment growth) under trend forecast conditions, and the emission rates needed to accommodate growth while allowing for consistency with the goals of AB 32 (i.e., 1990 GHG emissions levels by 2020).

Table 7 – California 2020 GHG Emissions, Population Projections and GHG Efficiency Thresholds - All Inventory Sectors

All Inventory Sectors Greenhouse Gas Emissions Target	426,500,000
Population	44,135,923
Employment	20,194,661
California Service Population (Population + Employment)	64,330,584
AB 32 Goal GHG emissions (metric tons CO_2e)/SP[1]	**6.6**

Notes: AB = Assembly Bill; CO_2e = carbon dioxide equivalent; GHG = greenhouse gas; SP = service population.
[1] Greenhouse gas efficiency levels were calculated using only the "land use-related" sectors of ARB's emissions inventory.
Please refer to Appendix D for detailed calculations.
Sources: Data compiled by EDAW 2009, ARB 2009a, DOF 2009, EDD 2009, ICF Jones & Stokes 2009.

If a general plan demonstrates, through dividing the emissions inventory projections (MT CO_2e) by the amount of growth that would be accommodated in 2020, that it could meet the GHG efficiency metrics proposed in this section (6.6 MT CO_2e/SP from all emission

sectors, as noted in Table 7), then the amount of GHG emissions associated with the general plan would be considered less than significant, regardless of its size (and magnitude of GHG emissions). In other words, the general plan would accommodate growth in a manner that would not hinder the State's ability to achieve AB 32 goals, and thus, would be less than significant for GHG emissions and their contribution to climate change. The efficiency metric would not penalize well-planned communities that propose a large amount of development. Instead, the SP-based GHG efficiency metric acts to encourage the types of development that BAAQMD and OPR support (i.e., infill and transit-oriented development) because it tends to reduce GHG and other air pollutant emissions overall, rather than discourage large developments for being accompanied by a large mass of GHG emissions. Plans that are more GHG efficient would have no or limited mitigation requirements which would help them complete the CEQA process for General Plans and other plans more readily than plans that promote GHG inefficiencies which will require detailed design of mitigation during the CEQA process and could subject a plan to potential challenge as to whether all feasible mitigation was identified and adopted. This type of threshold can shed light on a well-planned general plan that accommodates a large amount of growth in a GHG-efficient way.

When analyzing long-range plans, such as general plans, it is important to note that the planning horizon will often surpass the 2020 timeframe for implementation of AB 32. Executive Order S-3-05 establishes a more aggressive emissions reduction goal for the year 2050 of 80 percent below 1990 emissions levels. The year 2020 should be viewed as a milestone year, and the general plan should not preclude the community from a trajectory toward the 2050 goal. However, the 2020 timeframe is examined in this threshold evaluation because doing so for the 2050 timeframe (with respect to population, employment, and GHG emissions projections) would be too speculative. Advances in technology and policy decisions at the state level will be needed to meet the aggressive 2050 goals. It is beyond the scope of the analysis tools available at this time to examine reasonable emissions reductions that can be achieved through CEQA analysis in the year 2050. As the 2020 timeframe draws nearer, BAAQMD will need to reevaluate the threshold to better represent progress toward 2050 goals.

2.3.4 CLIMATE ACTION PLANS

Finally, many local agencies have already undergone or plan to undergo efforts to create general or other plans that are consistent with AB 32 goals. The District encourages such planning efforts and recognizes that careful upfront planning by local agencies is invaluable to achieving the state's GHG reduction goals. If a project is consistent with an adopted Qualified Climate Action Plan or a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS) developed pursuant to SB 375 that addresses the project's GHG emissions, it can be presumed that the project will not have significant GHG emission impacts. This approach is consistent with CEQA Guidelines Section 15064(h)(3), which provides that a "lead agency may determine that a project's incremental contribution to a cumulative effect is not cumulatively considerable if the project will comply with the requirements in a previously approved plan or mitigation

program which provides specific requirements that will avoid or substantially lessen the cumulative problem."

A qualified Climate Action Plan (or similar adopted policies, ordinances and programs) is one that is consistent with all of the AB 32 Scoping Plan measures and goals. The Climate Action Plan should identify a land use design, transportation network, goals, policies and implementation measures that would achieve AB 32 goals. Plans with horizon years beyond 2020 should consider continuing the downward reduction path set by AB 32 and move toward climate stabilization goals established in Executive Order S-3-05.

Qualified Climate Action Plans

A qualified Climate Action Plan adopted by a local jurisdiction should include the following. The District's revised CEQA Guidelines will provide the methodology to determine if a Climate Action Plan meets these requirements.

- GHG Inventory for Current Year and Forecast for 2020 (and for 1990 if the reduction goal is based on 1990 emission levels).
- An adopted GHG Reduction Goal for 2020 for the jurisdiction from all sources (existing and future) which is at least one of the following: 1990 GHG emission levels, 15 percent below 2008 emission levels, or 28 percent below BAU Forecasts for 2020 (if including non-land use sector emissions in the local inventory; otherwise can use 26.2 percent if only including land use sector emissions).
- Identification of feasible reduction measures to reduce GHG emissions for 2020 to the identified target.
- Application of relevant reduction measures included in the AB 32 Scoping Plan that are within the jurisdiction of the local land use authority (such as building energy efficiency, etc.).
- Quantification of the reduction effectiveness of each of the feasible measures identified including disclosure of calculation method and assumptions.
- Identification of implementation steps and financing mechanisms to achieve the identified goal by 2020.
- Procedures for monitoring and updating the GHG inventory and reduction measures at least twice before 2020 or at least every five years.
- Identification of responsible parties for Implementation.
- Schedule of implementation.
- Certified CEQA document, or equivalent process (see below).

Local Climate Action Policies, Ordinances and Programs

Air District staff recognizes that many communities in the Bay Area have been proactive in planning for climate change but have not yet developed a stand-alone Climate Action Plan that meets the above criteria. Many cities and counties have adopted climate action policies, ordinances and program that may in fact achieve the goals of a qualified climate action plan. Staff recommends that if a local jurisdiction can demonstrate that its collective set of climate action policies, ordinances and other programs is consistent with AB 32, includes requirements or feasible measures to reduce GHG emissions and achieves one of the following GHG emission reduction goals,[3] the AB 32 consistency demonstration should be considered equivalent to a qualified climate action plan:

- 1990 GHG emission levels,
- 15 percent below 2008 emission levels, or
- 28 percent below BAU Forecasts for 2020 (if including non-land use sector emissions in the local inventory; otherwise can use 26.2 percent if only including land use sector emissions).

Sustainable Communities Strategy or Alternative Planning Strategy

A SCS (or APS) adopted pursuant to SB 375 must have the following characteristics:

- must meet the ARB identified reduction target;
- must have been adopted by the Metropolitan Planning Organization (MPO); and
- certification of the EIR for the associated Regional Transportation Plan (RTP) must be completed.

Qualified Climate Action Plans, SCSs or APSs are tied to the AB 32 reduction goals, would promote reductions on a plan level without impeding the implementation of GHG–efficient development, and would recognize the initiative of many Bay Area communities who have already developed or are in the process of developing a GHG reduction plan. The details required above for a qualified Climate Action Plan (or similar adopted policies, ordinances and programs) would provide the evidentiary basis for making CEQA findings that development consistent with the plan would result in feasible, measureable, and verifiable GHG reductions consistent with broad state goals such that projects approved under qualified Climate Action Plans or equivalent demonstrations would achieve their fair share of GHG emission reductions.

[3] Lead agencies using consistency with their jurisdiction's climate action policies, ordinances and programs as a measure of significance under CEQA Guidelines section 15064(h)(3) should check to make sure that the policies, ordinances and programs satisfy all of the requirements of that subsection before relying on them in a CEQA analysis.

2.3.5 STATIONARY SOURCE GHG THRESHOLD

Staff's recommended threshold for stationary source GHG emissions is based on estimating the GHG emissions from combustion sources for all permit applications submitted to the Air District in 2005, 2006 and 2007. The analysis is based only on CO_2 emissions from stationary sources, as that would cover the vast majority of the GHG emissions due to stationary combustion sources in the SFBAAB. The estimated CO_2 emissions were calculated for the maximum permitted amount, i.e. emissions that would be emitted if the sources applying for a permit application operate at maximum permitted load and for the total permitted hours. All fuel types are included in the estimates. For boilers burning natural gas, diesel fuel is excluded since it is considered a backup fuel and is used only if natural gas is not available. Emission values are estimated before any offsets (i.e., Emission Reduction Credits) are applied. GHG emissions from mobile sources, electricity use and water delivery associated with the operation of the permitted sources are not included in the estimates.

It is projected that a threshold level of 10,000 metric tons of CO_2e per year would capture approximately 95 percent of all GHG emissions from stationary sources in the SFBAAB. That threshold level was calculated as an average of the combined CO_2 emissions from all stationary source permit applications submitted to the Air District during the three year analysis period.

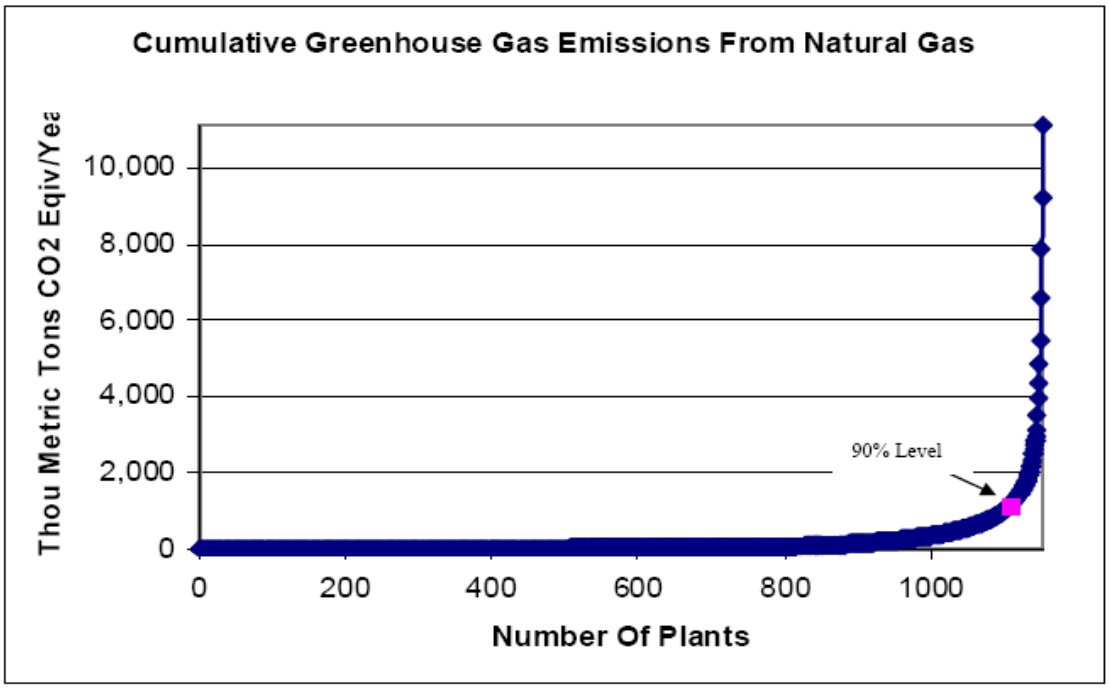


Figure 1 – Natural Gas Combustion Emissions from Stationary Sources in the SFBAAB

Staff recommends this 10,000 MT of CO_2/yr as it would address a broad range of combustion sources and thus provide for a greater amount of GHG reductions to be captured and mitigated through the CEQA process. As documented in the Scoping Plan, in order to achieve statewide reduction targets, emissions reductions need to be obtained through a broad range of sources throughout the California economy and this threshold would achieve this purpose.

This threshold would be considered an interim threshold and Air District staff will reevaluate the threshold as AB 32 Scoping Plan measures such as Cap and Trade are more fully developed at the state level.

2.3.6 SUMMARY OF JUSTIFICATION FOR GHG THRESHOLDS

The bright-line numeric threshold of 1,100 MT CO_2e/yr is a numeric emissions level below which a project's contribution to global climate change would be less than "cumulatively considerable." This emissions rate is equivalent to a project size of approximately 60 single-family dwelling units, and approximately 59 percent of all future projects and 92 percent of all emissions from future projects would exceed this level. For projects that are above this bright-line cutoff level, emissions from these projects would still be less than cumulatively significant if the project as a whole would result in an efficiency of 4.6 MT CO_2e per service population or better for mixed-use projects. Projects with emissions above 1,100 MT CO_2e/yr would therefore still be less than significant if they achieved project efficiencies below these levels. If projects as proposed exceed these levels, they would be required to implement mitigation measures to bring them back below the 1,100 MT CO_2e/yr bright-line cutoff or within the 4.6 MT CO_2e Service Population efficiency threshold. If mitigation did not bring a project back within the threshold requirements, the project would be cumulatively significant and could be approved only with a Statement of Overriding Considerations and a showing that all feasible mitigation measures have been implemented. A projects' GHG emissions would also be less than significant if they comply with a Qualified Climate Action Plan, SCS or APS that applies to the project.

As explained in the preceding analyses of these thresholds, the greenhouse gas emissions from land use projects expected between now and 2020 built in compliance with these thresholds would be approximately 26 percent below BAU 2020 conditions and thus would be consistent with achieving an AB 32 equivalent reduction. The 26 percent reduction from BAU 2020 from new projects built in conformance with these proposed thresholds would achieve an aggregate reduction of approximately 1.6 MMT CO_2e/yr, which is the level of emission reductions from new Bay Area land use sources needed to meet the AB 32 goals, per ARB's Scoping Plan as discussed above.

Projects with greenhouse gas emissions in conformance with these proposed thresholds would therefore not be considered significant for purposes of CEQA. Although the emissions from such projects would add an incremental amount to the overall greenhouse gas emissions that cause global climate change impacts, emissions from projects consistent with these thresholds would not be a "cumulatively considerable" contribution

under CEQA. Such projects would not be "cumulatively considerable" because they would be helping to solve the cumulative problem as a part of the AB 32 process.

California's response to the problem of global climate change is to reduce greenhouse gas emissions to 1990 levels by 2020 under AB 32 as a near-term measure and ultimately to 80 percent below 1990 levels by 2050 as the long-term solution to stabilizing greenhouse gas concentrations in the atmosphere at a level that will not cause unacceptable climate change impacts. To implement this solution, the Air Resources Board has adopted a Scoping Plan and budgeted emissions reductions that will be needed from all sectors of society in order to reach the interim 2020 target.

The land-use sector in the Bay Area needs to achieve aggregate emission reductions of approximately 1.6 MMT CO_2e/yr from new projects between now and 2020 to achieve this goal, as noted above, and each individual new project will need to achieve its own respective portion of this amount in order for the Bay Area land use sector as a whole to achieve its allocated emissions target. Building all of the new projects expected in the Bay Area between now and 2020 in accordance with the thresholds that District staff are proposing will achieve the overall appropriate share for the land use sector, and building each individual project in accordance with the proposed thresholds will achieve that individual project's respective portion of the emission reductions needed to implement the AB 32 solution. For these reasons, projects built in conformance with the proposed thresholds will be part of the solution to the cumulative problem, and not part of the continuing problem. They will allow the Bay Area's land use sector to achieve the emission reductions necessary from that sector for California to implement its solution to the cumulative problem of global climate change. As such, even though such projects will add an incremental amount of greenhouse gas emissions, their incremental contribution will be less than "cumulatively considerable" because they are helping to achieve the cumulative solution, not hindering it. Such projects will therefore not be "significant" for purposes of CEQA. (*See* CEQA Guidelines §15064(h)(1).)

The conclusion that land use projects that comply with these proposed thresholds is also supported by CEQA Guidelines Section 15030(a)(3), which provides that a project's contribution to a cumulative problem can be less that cumulatively considerable "if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact." In the case of greenhouse gas emissions associated with land use projects, achieving the amount of emission reductions below BAU that will be required to achieve the AB 32 goals is the project's "fair share" of the overall emission reductions needed under ARB's scoping plan to reach the overall statewide AB 32 emissions levels for 2020. If a project is designed to implement greenhouse gas mitigation measures that achieve a level of reductions consistent with what is required from all new land use projects to achieve the land use sector "budget" – *i.e.*, keeping overall project emissions below 1,100 MT CO_2e/yr or ensuring that project efficiency is better than 4.6 MT CO_2e/service population – then it will be implementing its share of the mitigation measures necessary to alleviate the cumulative impact, as shown in the analyses set forth above.

It is also worth noting that this "fair share" approach is flexible and will allow a project's significance to be determined by how well it is designed from a greenhouse-gas efficiency standpoint, and not just by the project's size. For example, a large high-density infill project located in an urban core nearby to public transit and other alternative transportation options, and built using state-of-the-art energy efficiency methods and improvements such as solar panels, as well as all other feasible mitigation measures, would not become significant for greenhouse gas purposes (and thus require a Statement of Overriding Considerations in order to be approved) simply because it happened to be a large project. Projects such as this hypothetical development with low greenhouse-gas emissions per service population are what California will need in the future in order to do its part in achieving a solution to the problem of global climate change. The determination of significance under CEQA should therefore take these factors into account, and staff's proposed significance thresholds would achieve this important policy goal.

3 COMMUNITY RISK AND HAZARD THRESHOLDS

To address community risk from air toxics, the Air District initiated the Community Air Risk Evaluation (CARE) program in 2004 to identify locations with high levels of risk from ambient toxic air contaminants (TAC) co-located with sensitive populations and use the information to help focus mitigation measures. In the first phase of the CARE program, the Air District developed an inventory of TAC emissions for 2005 and compiled demographic and heath indicator data. According to the findings of the Air District's Community Air Risk Evaluation (CARE) Program, diesel PM—mostly from on and off-road mobile sources—accounts for over 80 percent of the inhalation cancer risk from TACs in the Bay Area.

The Air District applied a regional air quality model using the 2005 emission inventory data to estimate excess cancer risk from ambient concentrations of important TAC species, including diesel PM, 1,3-butadiene, benzene, formaldehyde and acetaldehyde. Priority communities within the Bay Area defined as having higher emitting sources, highest air concentrations, and nearby low income and sensitive populations include the urban core areas of Concord, eastern San Francisco, western Alameda County, Redwood City/East Palo Alto, Richmond/San Pablo, and San Jose (BAAQMD 2006). The highest cancer risk levels from ambient TAC in the Bay Area also tend to occur in the core urban areas, along major roadways and adjacent to freeways. Cancer risks in areas along these major freeways are estimated to range from 200 to over 500 excess cases in a million.

Fifty percent of BAAQMD's population is estimated to have an ambient background inhalation cancer risk of less than 500 cases in one million. Table 8 presents a summary of percentages of the population exposed to varying levels of cancer risk from ambient TACs. Approximately two percent of the SFBAAB population is exposed to background risk levels of less than 200 excess cases in one million. This is in contrast to the upper percentile ranges where eight percent of the SFBAAB population is exposed to background risk levels of greater than 1,000 excess cases per one million.

Table 8 – Statistical Summary of Population-Weighted Ambient Cancer Risk	
Percentage of Population (Percent below level of ambient risk)	**Ambient Cancer Risk (inhalation cancer cases in one million)**
92	1,000
90	900
83	800
77	700
63	600
50	500
32	400
13	300
2	200
0	100
Source: Data compiled by EDAW 2009.	

3.2 PROPOSED THRESHOLDS OF SIGNIFICANCE

Project Type	Individual Project Threshold	Cumulative Threshold
Construction **Land Use (Source and Receptor)** **Stationary Source**	Compliance with Qualified Community Risk Reduction Plan OR Cancer Risk >10 in a million and Non-Cancer Hazard Index >1.0 and $PM_{2.5}$ level > 0.3 µg/m^3 (annual average) Zone of Influence: 1,000-foot radius from fence line of source or receptor	Compliance with Qualified Community Risk Reduction Plan OR Cancer Risk > 100 in a million and Non-cancer Hazard Index > 1.0 and $PM_{2.5}$ level > 0.8 µg/m^3 (annual average) Zone of Influence: 1,000-foot radius from fence line of source or receptor
Accidental Release of Acutely Hazardous Air Pollutants	Storage or use of acutely hazardous materials locating near receptors or receptors locating near stored or used acutely hazardous materials considered significant	
Plans	Identify (Overlay Zones) and include policies to reduce the impacts for: 1. Existing or planned sources of risks and hazards; 2. Community Risk Reduction Plan areas; and 3. 500 feet (or Air District-approved modeled distance) on each side of all freeways and high volume roadways	

3.3 JUSTIFICATION AND SUBSTANTIAL EVIDENCE SUPPORTING THRESHOLDS

The goal of the proposed thresholds is to ensure that no source creates, or receptor endures, a significant adverse impact from any individual project, and that the total of all nearby directly emitted risk and hazard emissions is also not significantly adverse.

A project proposing a new source or receptor would need to assess their impact within 1,000 feet, taking into account both its individual and nearby cumulative sources (i.e. proposed project plus existing and foreseeable future projects). Cumulative sources are the combined total risk values of each individual source within the 1,000-foot evaluation zone. A lead agency is encouraged to enlarge the 1,000-foot radius on a case-by-case basis if an unusually large source of risk or hazard emissions that may affect a proposed project is beyond the recommended radius.

The 1,000 foot distance was selected based on several factors. A summary of research findings in CARB's Land Use Compatibility Handbook (CARB 2005) indicates that traffic-related pollutants were higher than regional levels within approximately 1,000 feet downwind and that differences in health-related effects (such as asthma, bronchitis, reduced lung function, and increased medical visits) could be attributed in part to the proximity to heavy vehicle and truck traffic within 300 to 1,000 feet of receptors. Although CARB has recommended avoiding siting sensitive land uses within 500 feet of a freeway or high-volume urban roads, this approach uses 1,000 feet based on research that has indicated increased health effects in some cases out to as far as 1,000 feet. In the same study, CARB recommended avoiding siting sensitive land uses within 1,000 feet of a distribution center and major rail yard, which supports the use of a 1,000 feet evaluation distance in case such sources may be relevant to a particular project setting. A second consideration is that studies have shown that the concentrations of particulate matter tends to be reduced substantially or can even be indistinguishable from upwind background concentrations a distance 1,000 feet downwind from sources such as freeways or large distribution centers (Zhu et al. 2002, CARB 2005). Finally, a 1,000 foot zone of influence is also supported by Health & Safety Code §42301.6 (Notice for Possible Source Near School).

3.3.1 CONSTRUCTION, LAND USE AND STATIONARY SOURCE RISK AND HAZARD THRESHOLDS

Staff is proposing thresholds based on EPA's guidance for conducting air toxics analyses and making risk management decisions at the facility and community-scale level. The proposed thresholds would apply to both siting new sources and siting new receptors.

The proposed thresholds would consider projects consistent with a qualified Community Risk Reduction Plan (CRRP) adopted by the local jurisdiction that includes enforceable measures to reduce the community risk to acceptable levels to be less than significant.

Proposed development projects that are not consistent with a CRRP that has been adopted for the area where the project is proposed to be located would be considered to have a significant impact.

Projects proposed in areas where a CRRP has not been adopted and the potential exits to expose sensitive receptors or the general public to emissions-related risk in excess of the following thresholds from any source would be considered to have a significant air quality impact:

- *Increased Cancer Risk to Maximally Exposed Individual (MEI)* - Emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of carcinogenic TACs from any source result in an increased cancer risk greater than 10.0 in one million.

- *Increased Non-Cancer Risk to MEI* – Emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of non-carcinogenic TACs result in an increased chronic or acute Hazard Index from any source greater than 1.0.

- *Increased Ambient Concentration of $PM_{2.5}$* – Emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of $PM_{2.5}$ from any source would result in an average annual increase greater than 0.3 $\mu g/m^3$.

The conclusion that land use projects that comply with qualified Community Risk Reduction Plans are less than significant is supported by CEQA Guidelines Sections 15030(a)(3) and 15064(h)(3), which provides that a project's contribution to a cumulative problem can be less that cumulatively considerable if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact.

The 10.0 in one million cancer risk and 1.0 hazard index threshold is supported by EPA's guidance for conducting air toxics analyses and making risk management decisions at the facility and community-scale level which considers a range of acceptable cancer risks from one in a million to one in ten thousand (100 in a million). The guidance considers an acceptable range of cancer risks to be from one in a million to one in ten thousand. In protecting public health with an ample margin of safety, EPA strives to provide maximum feasible protection against risks to health from hazardous air pollutants (HAPs) by limiting risk to a level no higher than the one in ten thousand estimated risk that a person living near a source would be exposed to at the maximum pollutant concentrations for 70 years. This goal is described in the preamble to the benzene National Emissions Standards for Hazardous Air Pollutants (NESHAP) rulemaking (54 Federal Register 38044, September 14, 1989) and is incorporated by Congress for EPA's residual risk program under Clean Air Act (CAA) section 112(f).

The proposed thresholds would be protective of ambient air quality through the inclusion of a $PM_{2.5}$ threshold. Further, by providing an ambient threshold for $PM_{2.5,}$ this approach

would establish a bright line standard concerning particulate exposure that is consistent with EPA permitting requirements for stationary sources. The proposed threshold is an annual average increase in $PM_{2.5}$ emissions of 0.3 $\mu g/m^3$. This concentration is the U.S. EPA Significant Impact level (SIL) for $PM_{2.5}$. The SIL is a threshold applied to individual facilities that apply for a permit to emit a regulated pollutant in an area that meets the NAAQS. The state and EPA must determine if emissions from that facility will cause the air quality to worsen. If an individual facility projects an increase in emissions that result in ambient impacts greater than the established SIL, the permit applicant would be required to perform additional analyses to determine if those impacts will be more than the amount of the PSD increment. This analysis would combine the impact of the proposed facility when added on to all other sources in the area.

3.3.1.1 ACCIDENTAL RELEASE OF ACUTELY HAZARDOUS AIR EMISSIONS

The BAAQMD currently recommends, at a minimum, that the lead agency, in consultation with the administering agency of the Risk Management Prevention Program (RMPP), find that any project resulting in receptors being within the Emergency Response Planning Guidelines (ERPG) exposure level 2 for a facility has a significant air quality impact. ERPG exposure level 2 is defined as "the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action."

Staff proposes continuing with the current threshold for the accidental release of hazardous air pollutants. Staff recommends that agencies consult with the California Emergency Management Agency for the most recent guidelines and regulations for the storage of hazardous materials. Staff proposes that projects using or storing acutely hazardous materials locating near existing receptors, and projects resulting in receptors locating near facilities using or storing acutely hazardous materials be considered significant.

The current Accidental Release/Hazardous Air Emissions threshold of significance could affect all projects, regardless of size, and require mitigation for Accidental Release/Hazardous Air Emissions impacts.

3.3.2 CUMULATIVE RISK AND HAZARD THRESHOLDS

Projects consistent with a qualified CRRP adopted by the local jurisdiction that includes enforceable measures to reduce the community risk to acceptable levels would be considered less than significant.

Proposed development projects that are not consistent with a CRRP that has been adopted for the area where the project is proposed to be located would be considered to have a significant impact.

Projects proposed in areas where a CRRP has not been adopted and the potential to expose sensitive receptors or the general public to emissions-related risk in excess of the

following thresholds from the aggregate of cumulative sources would be considered to have a significant air quality impact.

- *Increased Cancer Risk to Maximally Exposed Individual (MEI)* - Emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of carcinogenic TACs from any source result in an increased cancer risk greater than 100.0 in one million.

- *Increased Non-Cancer Risk to MEI* – Emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of non-carcinogenic TACs result in an increased chronic or acute Hazard Index from any source greater than 1.0.

- *Increased Ambient Concentration of$PM_{2.5}$* – Emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of $PM_{2.5}$ from any source would result in an average annual increase greater than 0.8 $\mu g/m^3$.

The significance threshold of 100 in a million increased excess cancer risk and Hazard Index of 1.0 would be applied to the cumulative emissions. The 100 in a million threshold is based on EPA guidance for conducting air toxics analyses and making risk management decisions at the facility and community-scale level. The guidance considers an acceptable range of cancer risks to be from one in a million to one in ten thousand. In protecting public health with an ample margin of safety, EPA strives to provide maximum feasible protection against risks to health from hazardous air pollutants (HAPs) by limiting risk to a level no higher than the one in ten thousand (100 in a million) estimated risk that a person living near a source would be exposed to at the maximum pollutant concentrations for 70 years. This goal is described in the preamble to the benzene National Emissions Standards for Hazardous Air Pollutants (NESHAP) rulemaking (54 Federal Register 38044, September 14, 1989) and is incorporated by Congress for EPA's residual risk program under Clean Air Act (CAA) section 112(f). The 100 in a million excess cancer cases is also consistent with the ambient cancer risk in the most pristine portions of the Bay Area based on the District's recent regional modeling analysis.

The 0.8 $\mu g/m^3$ threshold is supported by EPA's proposed cumulative PSD threshold for all $PM_{2.5}$ sources and studies that examined the potential health impacts of roadway particles. This threshold level is appropriate for promoting review of emissions sources to prevent deterioration of air quality. Using existing and EPA-proposed environmental standards in this way to establish CEQA thresholds of significance is an appropriate and effective means of promoting consistency in significance determinations and integrating CEQA environmental review activities with other areas of environmental regulation.

The $PM_{2.5}$ concentration level of 0.8 $\mu g/m^3$ is based on a proposed rule being evaluated by U.S. EPA in developing significant impacts levels (SILs) for prevention of significant deterioration for particulate matter less than 2.5 micrometers (Federal Register 40 CFR Parts 51 and 52, September 21, 2007). EPA is proposing a PSD threshold of 0.8 $\mu g/m^3$ as

the cumulative threshold for all $PM_{2.5}$ sources. The 0.8 $\mu g/m^3$ standard was developed by scaling the PM_{10} SIL values by the ratio of direct $PM_{2.5}$ to direct PM_{10} emissions. The $PM_{2.5}/PM_{10}$ emissions ratio is based on the national average derived from the 2001 extrapolation of the EPA's 1999 National Emissions Inventory. The District believes that the 0.80 $\mu g/m^3$, which is based on direct PM emissions, is more representative of the mixture of PM sources in the Bay Area. In a recent PM study, the Air District found that direct emissions from wood burning and fossil fuel combustion contribute over one-half of annual $PM_{2.5}$ emissions. This threshold is also consistent with the estimated California background level and the estimated background level of the more remote areas of the Bay Area. The rationale for selecting 1,000 feet was explained in the discussion of Option 2 for siting new receptors above.

This threshold is also supported from several medical research studies that have linked near-road pollution exposure to a variety of adverse health outcomes impacting children and adults. One notable study conducted by Dr. Michael Kleinman and colleagues at the EPA-funded Southern California Particle Center studied the potential of roadway particles to aggravate allergic and immune responses in mice. Using mice that were not inherently susceptible, the researchers placed these mice at various distances downwind of State Road 60 and Interstate 5 freeways to test the effect these roadway particles have on their immune system. They found that within 5 meters of the roadway, there was a significant allergic response and elevated production of specific antibodies. At 150 meters (492 feet) and 500 meters (1,640 feet) downwind of the roadway, these effects were not statistically significant.

In another significant study, the University of Washington (Ven Hee et al, 2009) conducted a survey involving 3,827 participants that aimed to determine the effect of residential traffic exposure on two preclinical indicators of heart failure; left ventricular mass index (LVMI), measured by the cardiac magnetic resonance imaging (MRI), and ejection fraction. The studies classified participants based on the distance between their residence and the nearest interstate highway, state or local highway, or major arterial road. Four distance groups were defined: less than 50 meters (165 feet), 50-100 meters, 101-150 meters, and greater than 150 meters. After adjusting for demographics, behavioral, and clinical covariates, the study found that living within 50 meters of a major roadway was associated with a 1.4 g/m^2 higher LVMI than living more than 150 meters from one. This suggests an association between traffic-related air pollution and increased prevalence of a preclinical predictor of heart failure among people living near roadways.

To quantify the roadway concentrations that are contributing to the health impacts, the Air District modeled the scenario studied by Dr. Kleinman. In Dr. Kleinman's study emissions were estimated for Los Angeles using the EMFAC model. Annual average vehicle traffic data taken from Caltrans was used in the roadway model (CAL3QHCR) to estimate the downwind $PM_{2.5}$ concentrations at 50 meters and 150 meters. Additionally, emissions were assumed to occur from 10:00 a.m. to 2:00 p.m. corresponding to the time in which the mice were exposed during the study. The results of the modeling indicate

that at 150 meters, the downwind concentration is 0.78 $\mu g/m^3$, which is consistent with the EPA-recommended SIL of 0.8 $\mu g/m^3$.

3.3.3 PLAN-LEVEL RISK AND HAZARD THRESHOLDS

Staff proposes plan-level thresholds that will encourage a programmatic approach to addressing the overall adverse conditions resulting from risks and hazards that many Bay Area communities experience. By designating overlay zones in land use plans, local land use jurisdictions can take preemptive action before project-level review to reduce the potential for significant exposures to risk and hazard emissions. While this will require more up-front work at the general plan level, in the long-run this approach is a more feasible approach consistent with District and CARB guidance about siting sources and sensitive receptors that is more effective than project by project consideration of effects that often has more limited mitigation opportunities. This approach would also promote more robust cumulative consideration of effects of both existing and future development for the plan-level CEQA analysis as well as subsequent project-level analysis.

For local plans to have a less-than-significant impact with respect to potential risks and hazards, overlay zones would have to be established around existing and proposed land uses that would emit these air pollutants. Overlay zones to avoid risk impacts should be reflected in local plan policies, land use map(s), and implementing ordinances (e.g., zoning ordinance). The overlay zones around existing and future risk sources would be delineated using the quantitative approaches described above for project-level review and the resultant risk buffers would be included in the General Plan (or the EIR for the General Plan) to assist in site planning. BAAQMD will provide guidance as to the methods used to establish the TAC buffers and what standards to be applied for acceptable exposure level in the updated CEQA Guidelines document. Special overlay zones of at least 500 feet (or an appropriate distance determined by modeling and approved by the Air District) on each side of all freeways and high volume roadways would be included in this proposed threshold.

The threshold of significance for plan impacts could affect all plan adoptions and amendments and require mitigation for a plan's air quality impacts. Where sensitive receptors would be exposed above the acceptable exposure level, the plan impacts would be considered significant and mitigation would be required to be imposed either at the plan level (through policy) or at the project level (through project level requirements).

3.3.4 COMMUNITY RISK REDUCTION PLANS

The goal of a Community Risk Reduction Plan would be to bring TAC and $PM_{2.5}$ concentrations for the entire community covered by the Plan down to acceptable levels as identified by the local jurisdiction and approved by the Air District. This approach provides local agencies a proactive alternative to addressing communities with high levels of risk on a project-by-project approach. This approach is supported by CEQA Guidelines Section 15030(a)(3), which provides that a project's contribution to a cumulative problem can be less than cumulatively considerable "if the project is required

to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact." This approach is also further supported by CEQA Guidelines Section 15064(h)(3), which provides that a project's contribution to a cumulative effect is not considerable "if the project will comply with the requirements in a previously approved plan or mitigation program which provides specific requirements that will avoid or substantially lessen the cumulative problem."

Qualified Community Risk Reduction Plans

A qualified Community Risk Reduction Plan adopted by a local jurisdiction should:

- Evaluate current and future emissions and concentrations of TACs and $PM_{2.5}$.
- Establish risk and exposure reduction targets for the community, including for subareas located near sources of air pollution.
- Identify measures to reduce exposures.
- Identify implementation measures to reduce exposures.
- Includes procedures for monitoring and updating the TAC inventory, modeling and reduction measures, in coordination with Air District staff.
- Include a certified CEQA document.

4 CRITERIA POLLUTANT THRESHOLDS

4.2 PROPOSED THRESHOLDS OF SIGNIFICANCE

Project Construction	
Pollutant	**Average Daily (pounds/day)**
ROG (reactive organic gases)	54
NO_X (nitrogen oxides)	54
PM_{10} (exhaust) (particulate matter-10 microns)	82
$PM_{2.5}$ (exhaust) (particulate matter-2.5 microns)	54
$PM_{10}/PM_{2.5}$ (fugitive dust)	Best Management Practices
Local CO (carbon monoxide)	None

Project Operations		
Pollutant	**Average Daily (pounds/day)**	**Maximum Annual (tons/year)**
ROG	54	10
NO_X	54	10
PM_{10}	82	15
$PM_{2.5}$	54	10
Local CO	9.0 ppm (8-hour average), 20.0 ppm (1-hour average)	

Plans
1. Consistency with Current Air Quality Plan control measures 2. Projected VMT or vehicle trip increase is less than or equal to projected population increase

4.3 JUSTIFICATION AND SUBSTANTIAL EVIDENCE SUPPORTING THRESHOLDS

4.3.1 PROJECT CONSTRUCTION CRITERIA POLLUTANT THRESHOLDS

Staff proposes criteria pollutant construction thresholds that add significance criteria for exhaust emissions to the existing fugitive dust criteria employed by the Air District. While our current Guidelines considered construction exhaust emissions controlled by the overall air quality plan, the implementation of new and more stringent state and federal standards over the past ten years now warrants additional control of this source of emissions.

The average daily criteria air pollutant and precursor emission levels shown above are recommended as the thresholds of significance for construction activity for exhaust emissions. These thresholds represent the levels above which a project's individual

emissions would result in a considerable contribution (i.e., significant) to the SFBAAB's existing non-attainment air quality conditions and thus establish a nexus to regional air quality impacts that satisfies CEQA requirements for evidence-based determinations of significant impacts.

For fugitive dust emissions, staff recommends following the current best management practices approach which has been a pragmatic and effective approach to the control of fugitive dust emissions. Studies have demonstrated (Western Regional Air Partnership, U.S.EPA) that the application of best management practices at construction sites have significantly controlled fugitive dust emissions. Individual measures have been shown to reduce fugitive dust by anywhere from 30 percent to more than 90 percent. In the aggregate best management practices will substantially reduce fugitive dust emissions from construction sites. These studies support staff's recommendation that projects implementing construction best management practices will reduce fugitive dust emissions to a less than significant level.

4.3.2 PROJECT OPERATION CRITERIA POLLUTANT THRESHOLDS

The proposed thresholds for project operations are the average daily and maximum annual criteria air pollutant and precursor levels shown above. These thresholds are based on the federal BAAQMD Offset Requirements to ozone precursors for which the SFBAAB is designated as a non-attainment area which is an appropriate approach to prevent further deterioration of ambient air quality and thus has nexus and proportionality to prevention of a regionally cumulative significant impact (e.g. worsened status of non-attainment). Despite non-attainment area for state PM_{10} and pending nonattainment for federal $PM_{2.5}$, the federal NSR Significant Emission Rate annual limits of 15 and 10 tons per year, respectively, are proposed thresholds as BAAQMD has not established an Offset Requirement limit for $PM_{2.5}$ and the existing limit of 100 tons per year is much less stringent and would not be appropriate in light of our pending nonattainment designation for the federal 24-hour $PM_{2.5}$ standard. These thresholds represent the emission levels above which a project's individual emissions would result in a cumulatively considerable contribution to the SFBAAB's existing air quality conditions. The thresholds would be an evaluation of the incremental contribution of a project to a significant cumulative impact. These threshold levels are well-established in terms of existing regulations as promoting review of emissions sources to prevent cumulative deterioration of air quality. Using existing environmental standards in this way to establish CEQA thresholds of significance under Guidelines section 15067.4 is an appropriate and effective means of promoting consistency in significance determinations and integrating CEQA environmental review activities with other areas of environmental regulation. (*See Communities for a Better Environment v. California Resources Agency* (2002) 103 Cal. App. 4th 98, 111.[4])

[4] The Court of Appeal in the *Communities for a Better Environment* case held that existing regulatory standards could not be used as a definitive determination of whether a project would be significant under CEQA where there is substantial evidence to the contrary. Staff's proposed thresholds would not do that. The thresholds are levels at which a project's emissions would normally be significant, but would not be binding on a lead agency if there is contrary evidence in the record.

4.3.3 LOCAL CARBON MONOXIDE THRESHOLDS

The proposed carbon monoxide thresholds are based solely on ambient concentration limits set by the California Clean Air Act for Carbon Monoxide and Appendix G of the State of California CEQA Guidelines.

Since the ambient air quality standards are health-based (i.e., protective of public health), there is substantial evidence (i.e., health studies that the standards are based on) in support of their use as CEQA significance thresholds. The use of the ambient standard would relate directly to the CEQA checklist question. By not using a proxy standard, there would be a definitive bright line about what is or is not a significant impact and that line would be set using a health-based level.

The CAAQS of 20.0 ppm and 9 ppm for 1-hour and 8-hour CO, respectively, would be used as the thresholds of significance for localized concentrations of CO. Carbon monoxide is a directly emitted pollutant with primarily localized adverse effects when concentrations exceed the health based standards established by the California Air Resources Board (ARB).

In addition, Appendix G of the State of California CEQA Guidelines includes the checklist question: Would the project violate any air quality standard or contribute substantially to an existing or projected air quality violation? Answering yes to this question would indicate that the project would result in a significant impact under CEQA. The use of the ambient standard would relate directly to this checklist question.

4.3.4 PLAN-LEVEL CRITERIA POLLUTANT THRESHOLDS

This proposed threshold achieves the same goals as the Air District's current approach while alleviating the existing analytical difficulties and the inconsistency of comparing a plan update with AQP growth projections that may be up to several years old. Eliminating the analytical inconsistency provides better nexus and proportionality for evaluating air quality impacts for plans.

Over the years staff has received comments on the difficulties inherent in the current approach regarding the consistency tests for population and VMT growth. First, the population growth estimates used in the most recent AQP can be up to several years older than growth estimates used in a recent plan update, creating an inconsistency in this analysis. Staff recommends that this test of consistency be eliminated because the Air District and local jurisdictions all use regional population growth estimates that are disaggregated to local cities and counties. In addition, the impact to air quality is not necessarily growth but where that growth is located. The second test, rate of increase in vehicle use compared to growth rate, will determine if planned growth will impact air quality. Compact infill development inherently has less vehicle travel and more transit opportunities than suburban sprawl.

Second, the consistency test of comparing the rate of increase in VMT to the rate of increase in population has been problematic at times for practitioners because VMT is not always available with the project analysis. Staff recommends that either the rate of increase in VMT or vehicle trips be compared to the rate of increase in population. Staff also recommends that the growth estimates used in this analysis be for the years covered by the plan. Staff also recommends that the growth estimates be obtained from the Association of Bay Area Governments since the Air District uses ABAG growth estimates for air quality planning purposes.

5 ODOR THRESHOLDS

5.2 PROPOSED THRESHOLDS OF SIGNIFICANCE

Project Operations – Source or Receptor	Plans
1. More than one confirmed complaint per year averaged over a three year period; or 2. More than three unconfirmed complaints per year averaged over a three year period	Identify (Overlay Zones) and include policies to reduce the impacts of existing or planned sources of odors

5.3 JUSTIFICATION AND SUBSTANTIAL EVIDENCE SUPPORTING THRESHOLDS

Staff proposes continuing the current CEQA significance threshold for odors (based on complaint history). The current approach has proven adaptable to different projects and locations and thus continuation of the current approach with more qualitative guidance is considered an appropriate approach to CEQA evaluation.

Odors are generally considered a nuisance, but can result in a public health concern. Some land uses that are needed to provide services to the population of an area can result in offensive odors, such as filling portable propane tanks or recycling center operations. When a proposed project includes the siting of sensitive receptors in proximity to an existing odor source, or when siting a new source of potential odors, the following qualitative evaluation should be performed.

When determining whether potential for odor impacts exists, it is recommended that Lead Agencies consider the following factors and make a determination based on evidence in each qualitative analysis category:

- **Distance**: Use the screening-level distances in Table 9.

- **Wind Direction:** Consider whether sensitive receptors are located upwind or downwind from the source for the most of the year. If odor occurrences associated with the source are seasonal in nature, consider whether sensitive receptors are located downwind during the season in which odor emissions occur.

- **Complaint History:** Consider whether there is a history of complaints associated with the source. If there is no complaint history associated with a particular source (perhaps because sensitive receptors do not already exist in proximity to the source), consider complaint-history associated with other similar sources in BAAQMD's jurisdiction with potential to emit the same or similar types of odorous chemicals or compounds, or that accommodate similar types of processes.

- **Character of Source:** Consider the character of the odor source, for example, the type of odor events according to duration of exposure or averaging time (e.g., continuous release, frequent release events, or infrequent events).

- **Exposure:** Consider whether the project would result in the exposure of a substantial number of people to odorous emissions.

Table 9 – Screening Distances for Potential Odor Sources

Type of Operation Project Screening	Distance
Wastewater Treatment Plant	2 miles
Wastewater Pumping Facilities	1 mile
Sanitary Landfill	2 miles
Transfer Station	1 mile
Composting Facility	1 mile
Petroleum Refinery	2 miles
Asphalt Batch Plant	2 miles
Chemical Manufacturing	2 miles
Fiberglass Manufacturing	1 mile
Painting/Coating Operations	1 mile
Rendering Plant	2 miles
Coffee Roaster	1 mile
Food Processing Facility	1 mile
Confined Animal Facility/Feed Lot/Dairy	1 mile
Green Waste and Recycling Operations	1 mile
Coffee Roaster	1 mile

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Climate Change Scoping Plan

a framework for change

DECEMBER 2008

Pursuant to AB 32
The California Global Warming Solutions Act of 2006

Prepared by
the California Air Resources Board
for the State of California

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EXECUTIVE SUMMARY

On September 27, 2006, Governor Schwarzenegger signed Assembly Bill 32, the Global Warming Solutions Act of 2006 (Núñez, Chapter 488, Statutes of 2006). The event marked a watershed moment in California's history. By requiring in law a reduction of greenhouse gas (GHG) emissions to 1990 levels by 2020, California set the stage for its transition to a sustainable, clean energy future. This historic step also helped put climate change on the national agenda, and has spurred action by many other states.

The California Air Resources Board (ARB or Board) is the lead agency for implementing AB 32, which set the major milestones for establishing the program. ARB met the first milestones in 2007: developing a list of discrete early actions to begin reducing greenhouse gas emissions, assembling an inventory of historic emissions, establishing greenhouse gas emission reporting requirements, and setting the 2020 emissions limit.

ARB must develop a Scoping Plan outlining the State's strategy to achieve the 2020 greenhouse gas emissions limit. This Scoping Plan, developed by ARB in coordination with the Climate Action Team (CAT), proposes a comprehensive set of actions designed to reduce overall greenhouse gas emissions in California, improve our environment, reduce our dependence on oil, diversify our energy sources, save energy, create new jobs, and enhance public health.

This "Approved Scoping Plan" was adopted by the Board at its December 11, 2008 meeting. The measures in this Scoping Plan will be developed over the next two years and be in place by 2012.

Reduction Goals

This plan calls for an ambitious but achievable reduction in California's carbon footprint. Reducing greenhouse gas emissions to 1990 levels means cutting approximately 30 percent from business-as-usual emission levels projected for 2020, or about 15 percent from today's levels. On a per-capita basis, that means reducing our annual emissions of 14 tons of carbon dioxide equivalent for every man, woman and child in California down to about 10 tons per person by 2020. This challenge also presents a magnificent opportunity to transform California's economy into one that runs on clean and sustainable technologies, so that all Californians are able to enjoy their rights in the future to clean air, clean water, and a healthy and safe environment.

Significant progress can be made toward the 2020 goal relying on existing technologies and improving the efficiency of energy use. A number of solutions are "off the shelf," and many – especially investments in energy conservation and efficiency – have proven economic benefits. Other solutions involve improving our state's infrastructure, transitioning

to cleaner and more secure sources of energy, and adopting 21st century land use planning and development practices.

A Clean Energy Future

Getting to the 2020 goal is not the end of the State's effort. According to climate scientists, California and the rest of the developed world will have to cut emissions by 80 percent from today's levels to stabilize the amount of carbon dioxide in the atmosphere and prevent the most severe effects of global climate change. This long range goal is reflected in California Executive Order S-3-05 that requires an 80 percent reduction of greenhouse gases from 1990 levels by 2050.

Reducing our greenhouse gas emissions by 80 percent will require California to develop new technologies that dramatically reduce dependence on fossil fuels, and shift into a landscape of new ideas, clean energy, and green technology. The measures and approaches in this plan are designed to accelerate this necessary transition, promote the rapid development of a cleaner, low carbon economy, create vibrant livable communities, and improve the ways we travel and move goods throughout the state. This transition will require close coordination of California's climate change and energy policies, and represents a concerted and deliberate shift away from fossil fuels toward a more secure and sustainable future. This is the firm commitment that California is making to the world, to its children and to future generations.

Making the transition to a clean energy future brings with it great opportunities. With these opportunities, however, also come challenges. As the State moves ahead with the development and implementation of policies to spur this transition, it will be necessary to ensure that they are crafted to not just cut greenhouse gas emissions and move toward cleaner energy sources, but also to ensure that the economic and employment benefits that will accompany the transition are realized in California. This means that particular attention must be paid to fostering an economic environment that promotes and rewards California-based investment and development of new technologies and that adequate resources are devoted to building and maintaining a California-based workforce equipped to help make the transition.

A Public Process

Addressing climate change presents California with a challenge of unprecedented scale and scope. Success will require the support of Californians up and down the state. At every step of the way, we have endeavored to engage the public in the development of this plan and our efforts to turn the tide in the fight against global warming.

In preparing the Draft Scoping Plan, ARB and CAT subgroups held dozens of workshops, workgroups, and meetings on specific technical issues and policy measures. Since the release of the draft plan in late June, we have continued our extensive outreach with workshops and webcasts throughout the state. Hundreds of Californians showed up to share their thoughts about the draft plan, and gave us their suggestions for improving it. We've received thousands of postcards, form letters, emails, and over 1,000 unique comments

posted to our website or sent by mail. All told, more than 42,000 people commented on the draft Plan.

ARB catalogued and publicly posted all the comments we received. In many instances, we engaged experts and staff at our partner agencies for additional evaluation of comments and suggestions.

This plan reflects the input of Californians at every level. Our partners at other State agencies, in the legislature, and at the local government level have provided key input. We've met with members of community groups to address environmental justice issues, with representatives of California's labor force to ensure that good jobs accompany our transition to a clean energy future, and with representatives of California's small businesses to ensure that this vital part of our state's economic engine flourishes under this plan. We've heeded the advice of public health and environmental experts throughout the state to design the plan so that it provides valuable co-benefits in addition to cutting greenhouse gases. We've also worked with representatives from many of California's leading businesses and industries to craft a plan that works in tandem with the State's efforts to continue strong economic growth.

In short, we've heard from virtually every sector of California's society and economy, reflecting the fact that the plan will touch the life of almost every Californian in some way.

Scoping Plan Recommendations

The recommendations in this plan were shaped by input and advice from ARB's partners on the Climate Action Team, as well as the Environmental Justice Advisory Committee (EJAC), the Economic and Technology Advancement Advisory Committee (ETAAC), and the Market Advisory Committee (MAC). Like the Draft Scoping Plan, the strength of this plan lies in the comprehensive array of emission reduction approaches and tools that it recommends.

Key elements of California's recommendations for reducing its greenhouse gas emissions to 1990 levels by 2020 include:

- **Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;**
- **Achieving a statewide renewables energy mix of 33 percent;**
- **Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system;**
- **Establishing targets for transportation-related greenhouse gas emissions for regions throughout California, and pursuing policies and incentives to achieve those targets;**

- **Adopting and implementing measures pursuant to existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard; and**
- **Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the State's long term commitment to AB 32 implementation.**

After Board approval of this plan, the measures in it will be developed and adopted through the normal rulemaking process, with public input.

Key Changes

This plan is built upon the same comprehensive approach to achieving reductions as the draft plan. However, as a result of the extensive public comment we received, this plan includes a number of general and measure-specific changes. The key changes and additions follow.

Additional Reports and Supplements

1. Economic and Public Health Evaluations: This plan incorporates an evaluation of the economic and public health benefits of the recommended measures. These analyses follow the same methodology used to evaluate the Draft Scoping Plan.[1]

2. CEQA Evaluation: This plan includes an evaluation of the potential environmental impacts of the Scoping Plan under the California Environmental Quality Act (CEQA).[2]

Programmatic Changes

1. Margin of Safety for Uncapped Sectors: The plan provides a 'margin of safety,' that is, additional reductions beyond those in the draft plan to account for measures in uncapped sectors that do not, or may not, achieve the estimated reduction of greenhouse gas emissions in this plan. Along with the certainty provided by the cap, this will ensure that the 2020 target is met.

2. Focus on Labor: The plan includes a discussion of issues directly related to California's labor interests and working families, including workforce development and career technical education. This additional element reflects ARB's existing activities and expanded efforts by State agencies, such as the Employment Development Department, to ensure that California will have a green technology workforce to address the challenges and opportunities presented by the transition to a clean energy future.

[1] Staff will provide an update to the Board to respond to comments received on these analyses.

[2] This evaluation is contained in Appendix J.

3. Long Term Trajectory: The plan includes an assessment of how well the recommended measures put California on the long-term reduction trajectory needed to do our part to stabilize the global climate.

4. Carbon Sequestration: The plan describes California's role in the West Coast Regional Carbon Sequestration Partnership (WESTCARB), a public-private collaboration to characterize regional carbon capture and sequestration opportunities. In addition, the plan expresses support for near-term development of sequestration technology. This plan also acknowledges the important role of terrestrial sequestration in our forests, rangelands, wetlands, and other land resources.

5. Cap-and-Trade Program: The plan provides additional detail on the proposed cap-and-trade program including a discussion regarding auction of allowances, a discussion of the proposed role for offsets, the role of voluntary renewable power purchases, and additional detail on the mechanisms to be developed to encourage voluntary early action.

6. Implementation: The plan provides additional detail on implementation, tracking and enforcement of the recommended actions, including the important role of local air districts.

Changes to Specific Measures and Programs

1. Regional Targets: ARB re-evaluated the potential benefits from regional targets for transportation-related greenhouse gases in consultation with regional planning organizations and researchers at U.C. Berkeley. Based on this information, ARB increased the anticipated reduction of greenhouse gas emissions for Regional Transportation-Related Greenhouse Gas Targets from 2 to 5 million metric tons of CO_2 equivalent ($MMTCO_2E$).

2. Local Government Targets: In recognition of the critical role local governments will play in the successful implementation of AB 32, ARB added a section describing this role. In addition, ARB recommended a greenhouse gas reduction goal for local governments of 15 percent below today's levels by 2020 to ensure that their municipal and community-wide emissions match the State's reduction target.

3. Additional Industrial Source Measures: ARB added four additional measures to address emissions from industrial sources. These proposed measures would regulate fugitive emissions from oil and gas recovery and transmission activities, reduce refinery flaring, and require control of methane leaks at refineries. We

anticipate that these measures will provide 1.5 $MMTCO_2E$ of greenhouse gas reductions.

4. Recycling and Waste Re-Assessment: In consultation with the California Integrated Waste Management Board, ARB re-assessed potential measures in the Recycling and Waste sector. As a result of this review, ARB increased the anticipated reduction of greenhouse gas emissions from the Recycling and Waste Sector from 1 to 10 $MMTCO_2E$, incorporating measures to move toward high recycling and zero-waste.[3]

5. Green Building Sector: This plan includes additional technical evaluations demonstrating that green building systems have the potential to reduce approximately 26 $MMTCO_2E$ of greenhouse gases. These tools will be helpful in reducing the carbon footprint for new and existing buildings. However, most of these greenhouse gas emissions reductions will already be counted in the Electricity, Commercial/Residential Energy, Water or Waste sectors and are not separately counted toward the AB 32 goal in this plan.

6. High Global Warming Potential (GWP) Mitigation Fee: Currently many of the chemicals with very high Global Warming Potential (GWP)—typically older refrigerants and constituents of some foam insulation products—are relatively inexpensive to purchase. ARB includes in this plan a Mitigation Fee measure to better reflect their impact on the climate. The fee is anticipated to promote the development of alternatives to these chemicals, and improve recycling and removal of these substances when older units containing them are dismantled.

7. Modified Vehicle Reductions: Based on current regulatory development, ARB modified the expected emissions reduction of greenhouse gases from the Heavy-Duty Vehicle Greenhouse Gas Emission Reduction (Aerodynamic Efficiency) measure and the Tire Inflation measure. The former measure is now expected to achieve 0.9 $MMTCO_2E$ while the latter is now expected to achieve 0.4 $MMTCO_2E$.

8. Discounting Low Carbon Fuel Standard Reductions: ARB modified the expected emission reductions from the Low Carbon Fuel Standard to reflect overlap in claimed benefits with California's clean car law (the Pavley greenhouse gas vehicle standards). This has the result of discounting expected reduction of greenhouse gas emissions from the Low Carbon Fuel Standard by approximately 10 percent.

[3] Research to help quantify these greenhouse gas emissions reductions is continuing, so only 1 $MMTCO_2E$ of these reductions are currently counted toward the AB 32 goal in this plan. Additional tons will be considered part of the safety margin.

A Balanced and Comprehensive Approach

Meeting the goals of AB 32 will require a coordinated set of strategies to reduce emissions throughout the economy. These strategies will fit within the comprehensive tracking, reporting, and enforcement framework that is already being developed and implemented. By 2020, a hard and declining cap will cover 85 percent of California's greenhouse gas emissions, helping to ensure that we meet our reduction targets on time.

AB 32 lays out a number of important factors that have helped to guide the development of this plan and will continue to be considered as regulations are developed over the next few years. Some of the key criteria that have and will be further considered are: cost-effectiveness; overall societal benefits like energy diversification and public health improvements; minimization of leakage; and impacts on specific sectors like small business and disproportionately impacted communities. The comprehensive approach in the plan reflects a balance among these and other important factors and will help to ensure that California meets its greenhouse gas reduction targets in a way that promotes and rewards innovation, is consistent with and helps to foster economic growth, and delivers improvements to the environment and public health.

Many of the measures in this plan complement and reinforce one another. For instance, the Low Carbon Fuel Standard, which reduces the carbon intensity of transportation fuels sold in California, will work in tandem with technology-forcing regulations designed to reduce greenhouse gas emissions from cars and trucks. Improvements in land use and the ways we grow and build our communities will further reduce emissions from the transportation sector.

Many of the measures also build on highly successful long-standing practices in California—such as energy efficiency and the use of renewable energy resources—that can be accelerated and expanded. Increasing the amount of energy we get from renewable energy sources, including placing solar arrays and solar water heaters on houses throughout California, will be supported by an increase in building standards for energy efficiency. Other measures address the transport and treatment of water throughout the state, reduce greenhouse gas emissions that come from ships in California's ports, and promote changes to agricultural and forestry practices. There are also measures designed to safely reduce or recover a range of very potent greenhouse gases – refrigerants and other industrial gases – that contribute to global warming at a level many times greater per ton emitted than carbon dioxide.

Many of the measures in this plan are designed to take advantage of the economic and innovation-related benefits that market-based compliance strategies can provide. Particularly in light of current economic uncertainty, it is important to ensure that California's climate policies be designed to promote and take advantage of economic opportunities while also cutting greenhouse gas emissions. For instance, the cap-and-trade program creates an opportunity for firms to seek out cost-effective emission reduction strategies and provides an incentive for technological innovation. California's clean car standards, which require manufacturers to meet annual average levels of greenhouse gas emissions for all cars they sell in California, also offer flexibility to help ensure compliance. Under California's clean

car standards, manufacturers who exceed compliance standards are permitted to bank credits for future use or sell them to other manufacturers. These types of compliance options will be key in ensuring that we are able to meet our reduction targets in a cost-effective manner.

Working with the Western Climate Initiative

California is working closely with six other states and four Canadian provinces in the Western Climate Initiative (WCI) to design a regional greenhouse gas emissions reduction program that includes a cap-and-trade approach. California's participation in WCI creates an opportunity to provide substantially greater reductions in greenhouse gas emissions from throughout the region than could be achieved by California alone. The larger scope of the program also expands the market for clean technologies and helps avoid leakage, that is, the shifting of emissions from sources within California to sources outside the state.

The WCI partners released the recommended design for a regional cap-and-trade program in September 2008.[4] ARB embraces the WCI effort, and will continue to work with WCI partners. The creation of a robust regional trading system can complement the other policies and measures included in this plan, and provide the means to achieve the reduction of greenhouse gas emissions needed from a wide range of sectors as cost-effectively as possible.

California's Economy, Environment, and Public Health

The approaches in this plan are designed to maximize the benefits that can accompany the transition to a clean energy economy. California has a long and successful track record of implementing environmental policies that also deliver economic benefits. This plan continues in that tradition.

AB 32: Evaluating the Economic Effects

The economic analysis of this plan indicates that implementation of the recommended strategies to address global warming will create jobs and save individual households money.[5] The analysis also indicates that measures in the plan will position California to move toward a more secure, sustainable future where we invest heavily in energy efficiency and clean technologies. The economic analysis indicates that implementation of that forward-looking approach also creates more jobs and saves individual households more money than if California stood by and pursued an unacceptable course of doing nothing at all to address our unbridled reliance on fossil fuels.

Specifically, analysis of the Scoping Plan indicates that projected economic benefits in 2020 compared to the business-as-usual scenario include:

- Increased economic production of $33 billion

[4] Details of the WCI recommendation are provided in Appendix D.

[5] See Appendix G.

- Increased overall gross state product of $7 billion
- Increased overall personal income by $16 billion
- Increased per capita income of $200
- Increased jobs by more than 100,000

Furthermore, the results of the economic analysis may underestimate the economic benefits of the plan since the models that were used do not account for savings that result from the flexibility provided under market-based programs.

AB 32: The Environmental and Public Health Costs of Inaction

A key factor that was not weighed in the overall economic analysis is the potential cost of doing nothing. When these costs are taken into account, the benefits associated with implementing a comprehensive plan to cut greenhouse gas emissions become even clearer. As a state, California is particularly vulnerable to the costs associated with unmitigated climate change.

A summary report from the California Climate Change Center notes that a warming California climate would generate more smoggy days by contributing to ozone formation while also fostering more large brush and forest fires. Continuing increases in global greenhouse gas emissions at business-as-usual rates would result, by late in the century, in California losing 90 percent of the Sierra snow pack, sea level rising by more than 20 inches, and a three to four times increase in heat wave days. These impacts will translate into real costs for California, including flood damage and flood control costs that could amount to several billion dollars in many regions such as the Central Valley, where urbanization and limited river channel capacity already exacerbate existing flood risks.[6] Water supply costs due to scarcity and increased operating costs would increase as much as $689 million per year by 2050.[7] ARB analysis shows that due to snow pack loss, California's snow sports sector would be reduced by $1.4 billion (2006 dollars) annually by 2050 and shed 14,500 jobs; many other sectors of California's economy would suffer as well.

Failing to address climate change also carries with it the risk of substantial public health costs, primarily as a result of rising temperatures. Sustained triple-digit heat waves increase the health risk for several segments of the population, especially the elderly. But higher average temperatures will also increase the interactions of smog-causing chemicals with sunlight and the atmosphere to produce higher volumes of toxic byproducts than would otherwise occur. In the 2006 report to the Governor

[6] A Summary Report from: California Climate Change Center. *Our Changing Climate: Assessing the Risks to California*. Document No. CEC-500-2006-077. July 2006. http://www.energy.ca.gov/2006publications/CEC-500-2006-077/CEC-500-2006-077.PDF (accessed October 12, 2008)

[7] A Report from: California Climate Change Center. *Climate Warming and Water Supply Management in California*. Document No. CEC-500-2005-195-SF. March 2006. pp.13-14 http://www.energy.ca.gov/2005publications/CEC-500-2005-195/CEC-500-2005-195-SF.PDF (accessed October 12, 2008).

from the California Climate Center, it was reported that global increases in temperature will lead to increased concentrations and emissions of harmful pollutants in California.[8] Some cities in California are disproportionately susceptible to temperature increases since they already have elevated pollution levels and are subject to the heat-island effect that reduces nighttime cooling, allowing heat to build up and magnify the creation of additional harmful pollution. Low-income communities are disproportionately impacted by climate change, lacking the resources to avoid or adapt to these impacts. For example, low-income residents are less likely to have access to air conditioning to prevent heat stroke and death in heat waves. For California, then, taking action with other regions and nations to help mitigate the impacts of climate change will help slow temperature rise. This in turn will likely result in fewer premature deaths from respiratory and heat-related causes, and many thousands fewer hospital visits and days of illness.

California cannot avert the impacts of global climate change by acting alone. We can, however, take a national and international leadership role in this effort by demonstrating that taking firm and reasoned steps to address global warming can actually help spur economic growth.

AB 32: Providing Savings for Households and Businesses

This plan builds upon California's thirty-year track record of pioneering energy efficiency programs. Many of the measures in the plan will deliver significant gains in energy efficiency throughout the economy. These gains, even after increases in per unit energy costs are taken into account, will help deliver annual savings of between $400 and $500 on average by 2020 for households, including low-income households.

Businesses, both large and small, will benefit too. By 2020, the efficiency measures in the plan will decrease overall energy expenditures for businesses even after taking into account projected rises in per unit energy costs. Since small businesses spend a greater proportional share of revenue on energy-related costs, they are likely to benefit the most. Furthermore, businesses throughout the state will benefit from the overall economic growth that is projected to accompany implementation of AB 32 between now and 2020.

Similar savings are projected in the transportation sector. By reducing greenhouse gas pollution from more efficient and alternatively-fueled cars and trucks under California's Clean Car law (the Pavley greenhouse gas standards), consumers save on operating costs through reduced fuel use. Although cars will be marginally more expensive, owners will be paid back with savings over the lifetime of the car, and the average new car buyer will have an extra $30 each month for other expenditures. Current estimates indicate that consumer savings in 2020 for California's existing

[8] A Report from: California Climate Change Center. *Scenarios of Climate Change in California: An Overview*. Document No. CEC-500-2005-186-SF. February 2006. http://www.energy.ca.gov/2005publications/CEC-500-2005-186/CEC-500-2005-186-SF.PDF (accessed October 12, 2008)

clean car standards will be over $12 billion. These savings give Californians the ability to invest their dollars in other sectors of the state's economy.

AB 32: Driving Investment and Job Growth

Addressing climate change also provides a strong incentive for investment in California. Our leadership in environmental and energy efficiency policy has already helped attract a large and growing share of the nation's venture capital investment in green technologies. Since AB 32 was signed into law, venture capital investment in California has skyrocketed. In the second quarter of 2008 alone, California dominated world investment in clean technology venture capital, receiving $800 million of the global total of $2 billion.[9]

These investments in building a new clean tech sector also translate directly into job growth. A study by U.C. Berkeley's Energy and Resources Group and Goldman School of Public Policy found that investments in green technologies produce jobs at a higher rate than investments in comparable conventional technologies.[10] And the National Venture Capital Association estimates that each $100 million in venture capital funding helps create 2,700 jobs, $500 million in annual revenues for two decades and many indirect jobs.[11]

AB 32: Improving Public Health

The public health analysis conducted for this Plan indicates that cutting greenhouse gases will also provide a wide range of additional public health and environmental benefits. By 2020, the economic value alone of the additional air-quality related benefits is projected to be on the order of $4.4 billion. Our analysis indicates that implementing the Scoping Plan will result in a reduction of 15 tons per day of combustion-generated soot (PM 2.5) and 61 tons per day of oxides of nitrogen (precursors to smog). These reductions in harmful air pollution would provide the following estimated health benefits in 2020, above and beyond those projected to be achieved as a result of California's other existing public health protection and improvement efforts:

- An estimated 780 premature deaths statewide will be avoided
- Almost 12,000 incidences of asthma and lower respiratory symptoms will be avoided

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[9] Press Release from Cleantech Network LLC, *Cleantech Venture Investment Reaches Record of $2 Billion in 2008*. July 08, 2008. http://cleantech.com/about/pressreleases/011008.cfm (accessed October 12, 2008)

[10] Report of the Renewable and Appropriate Energy Laboratory. *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?* Energy and Resources Group/Goldman School of Public Policy at University of California, Berkeley. April 13, 2004. http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf (accessed October 12, 2008)

[11] Report prepared for the National Venture Capital Association. *Venture Impact 2004: Venture Capital Benefits to the U.S. Economy*. Prepared by: Global Insight. June 2004. http://www.globalinsight.com/publicDownload/genericContent/07-20-04_fullstudy.pdf (accessed October 12, 2008)

- 77,000 work loss days will be avoided

In addition to the quantified health benefits, our analysis also indicates that implementation of the measures in the plan will deliver a range of other public health benefits. These include health benefits associated with local and regional transportation-related greenhouse gas targets that will facilitate greater use of alternative modes of transportation such as walking and bicycling. These types of moderate physical activities reduce many serious health risks including coronary heart disease, diabetes, hypertension and obesity.[12] Furthermore, as specific measures are developed, ARB and public health experts will work together to ensure that they are designed with an eye toward capturing a broad range of public health co-benefits.

The results of both the economic and public health analyses are clear: guiding California toward a clean energy future with reduced dependence on fossil fuels will grow our economy, improve public health, protect the environment and create a more secure future built on clean and sustainable technologies.

State Leadership

California is committed to once again lead and support a pioneering effort to protect the environment and improve public health while maintaining a vibrant economy. Every agency, department and division will bring climate change considerations into its policies, planning and analysis, building and expanding current efforts to green its fleet and buildings, and managing its water, natural resources, and infrastructure to reduce greenhouse gas emissions.

In all these efforts, California is exercising a leadership role in global action to address climate change. It is also exemplifying the essential role states play as the laboratories of innovation for the nation. As California has done in the past in addressing emissions that caused smog, the State will continue to develop innovative programs that benefit public health and improve our environment and quality of life.

Moving Beyond 2020

AB 32 requires a return to 1990 emission levels by 2020. The Scoping Plan is designed to achieve that goal. However, 2020 is by no means the end of California's journey to a clean energy future. In fact, that is when many of the strategies laid out in this plan will just be kicking into high gear.

Take, for example, the regional transportation-related greenhouse gas emissions targets. In order to achieve the deep cuts in greenhouse gas emissions we will need beyond 2020 it will be necessary to significantly change California's current land use and transportation planning policies. Although these changes will take time, getting started now will help put California

[12] Appendix H contains a reference list of studies documenting the public health benefits of alternative transportation.

on course to cut statewide greenhouse gas emissions by 80 percent in 2050 as called for by Governor Schwarzenegger.

Similarly, measures like the cap-and-trade program, energy efficiency programs, the California clean car standards, and the renewables portfolio standard will all play central roles in helping California meet its 2020 reduction requirements. Yet, these strategies will also figure prominently in California's efforts beyond 2020. Some of these measures, like energy efficiency programs and the renewables portfolio standard, have already delivered greenhouse gas emissions reduction benefits that will expand over time. Others, like the cap-and-trade program, will put in place a foundation on which to build well into the future. All of these measures, and many others in the plan, will ensure that California meets its 2020 target and is positioned to continue its international role as leader in the fight against global warming to 2050 and beyond.

A Shared Challenge

Californians are already responding to the challenge of reducing greenhouse gas emissions. Over 120 California cities and counties have signed on to the U.S. Conference of Mayors Climate Protection Agreement[13] and many have established offices of climate change and are developing comprehensive plans to reduce their carbon footprint. Well over 300 companies, municipalities, organizations and corporations are members of the California Climate Action Registry, reporting their greenhouse gas emissions on an annual basis. Many other businesses and corporations are making climate change part of their fiscal and strategic planning. ARB encourages these initial efforts and has set in place a policy to support and encourage other voluntary early reductions.

Successful implementation of AB 32 will depend on a growing commitment by a majority of companies to include climate change as an integral part of their planning and operations. Individuals and households throughout the state will also have to take steps to consider climate change at home, at work and in their recreational activities. To support this effort, this plan includes a comprehensive statewide outreach program to provide businesses and individuals with the widest range of information so they can make informed decisions about reducing their carbon footprints.

Californians will not have to wait for decades to see the benefits of a low carbon economy. New homes can achieve a near zero-carbon footprint with better building techniques and existing technologies, such as solar arrays and solar water heaters. Many older homes can be retrofitted to use far less energy than at present. A new generation of vehicles, including plug-in hybrids, is poised to appear in dealers' showrooms, and the development of the infrastructure to support hydrogen fuel cell cars continues. Cities and new developments will be more walkable, public transport will improve, and high-speed rail will give travelers a new clean transportation option.

[13] Mayors Climate Protection Center. *List of Participating Mayors.* http://www.usmayors.org/climateprotection/list.asp (accessed October 12, 2008)

That world is just around the corner. What lies beyond is even more exciting. Where will California be in 2050? By harnessing the ingenuity and creativity of our society and sparking the imagination of the next generation of Californians, California will make the transition to a clean-energy, low-carbon society and become a healthier, cleaner and more sustainable place to live. This plan charts a course toward that future.

ARB invites comment and input from the broadest array of the public and stakeholders as we move forward over the next two years to develop the individual measures, and develop the policies that will move us toward sustainable clean energy and away from fossil fuels. Your participation will help craft the mechanisms and measures to make this plan a reality. This is California's plan and together, we need to make the necessary changes to address the greatest environmental challenge we face. As Governor Schwarzenegger stated when he signed AB 32 into law two years ago, "We owe our children and we owe our grandchildren. We simply must do everything in our power to fight global warming before it is too late."

I. INTRODUCTION: A Framework for Change

California strengthened its commitment to address climate change when Governor Schwarzenegger signed Assembly Bill 32 (AB 32), the Global Warming Solutions Act of 2006 (Núñez, Chapter 488, Statutes of 2006). This groundbreaking legislation represents a turning point for California and makes it clear that a business-as-usual approach toward greenhouse gas emissions is no longer acceptable. In light of the need for strong and immediate action to counter the growing threat of global warming, AB 32 sets forth an aggressive timetable for achieving results.

AB 32 embodies the idea that California can continue to grow and flourish while reducing its greenhouse gas emissions and continuing its long-standing efforts to achieve healthy air, and protect and enhance public health. Achieving these goals will involve every sector of the state's $1.7 trillion economy and touch the life of every Californian.

As the lead agency for implementing AB 32, the California Air Resources Board (ARB or the Board) released a Draft Scoping Plan on June 26, 2008, which laid out a comprehensive statewide plan to reduce California's greenhouse gas emissions to 1990 levels by 2020. This draft plan set forth a comprehensive reduction strategy that combines market-based regulatory approaches, other regulations, voluntary measures, fees, policies, and programs that will significantly reduce emissions of greenhouse gases and help make our state cleaner, more efficient and more secure.

Based upon the numerous comments received on the draft, as well as additional staff analysis, ARB released a *Proposed* Scoping Plan on October 15, 2008. At its November 20 and 21, 2008 meeting, the Board heard staff presentations on the Proposed Scoping Plan and directed staff to make a number of modifications. This *Approved* Scoping Plan incorporates these modifications, as well as corrections from the November 14, 2008 errata sheet, but otherwise reflects the same measures of the Proposed Scoping Plan.

The Board approved this Scoping Plan at its December 11, 2008 meeting, providing specific direction for the State's greenhouse gas emissions reduction program. The recommended measures will be developed into regulations over the next two years, to go into effect by January 1, 2012. As specific measures in the plan are developed, we will update and adjust our regulatory proposals as necessary to ensure that they reflect any new information, additional analyses, new technologies or other factors that emerge during the process.

ARB has conducted a transparent, wide-ranging public process to develop the Scoping Plan, including numerous meetings, workshops, and seminars with stakeholders. Substantial input on the development of the Scoping Plan came from formal advisory committees, meetings with industrial and business groups, non-profit organizations and members of the public, as

well as written comments on the Draft Scoping Plan. ARB will continue its outreach activities to seek ongoing public input and will encourage early and continued involvement in the implementation of the plan from all Californians.

A. Summary of Changes from the Draft Scoping Plan

ARB released the June Draft Scoping Plan and requested public comment and input, while continuing to analyze the measures and their impact on California. Since the Draft Scoping Plan release, ARB received almost 1,000 unique written comments as well as hundreds of verbal comments at workshops and in meetings. Taking into account that some written comments were submitted by multiple individuals, all told more than 42,000 people have commented on the draft plan. ARB has also completed detailed economic and public health evaluations of its recommendations.

The key changes between the Draft Scoping Plan and the Scoping Plan are summarized below. The Scoping Plan includes the following modifications:

1. General

- Incorporates economic and public health analyses of the Scoping Plan. These analyses show that the recommendations in the Scoping Plan will have a net positive impact on both the economy and public health. These analyses follow the same methodology used to evaluate the Draft Scoping Plan.
- Provides a "margin of safety" by recommending additional greenhouse gas emissions reduction strategies to account for measures in uncapped sectors that do not achieve the greenhouse gas emissions reductions estimated in the Scoping Plan. Along with the certainty provided by the cap, this will ensure that the 2020 target is met.
- Expands the discussion of workforce development, education, and labor to more fully reflect existing activities and the role of other state agencies in ensuring an adequate green technology workforce.
- Assesses how well the recommended measures put California on the long-term reduction trajectory needed to do our part to stabilize the global climate.
- Describes California's role in the West Coast Regional Carbon Sequestration Partnership (WESTCARB), a public-private collaboration to characterize regional carbon capture and sequestration opportunities, and expresses support for near-term advancement of the technology and monitoring of its development. Acknowledges the important role of terrestrial sequestration.
- Provides greater detail on the mechanisms to be developed to encourage voluntary early action.
- Provides additional detail on implementation, tracking and enforcement of the recommended actions, including the important role of local air districts.

- Evaluates the potential environmental impacts of the Scoping Plan under the California Environmental Quality Act (CEQA). This evaluation is contained in Appendix J.

2. Proposed Measures

- Provides greater detail on the proposed cap-and-trade program including more detail on the allocation and auction of allowances, and clarification of the proposed role of offsets.
- Re-evaluates the potential benefits from regional targets for transportation-related greenhouse gases in consultation with regional planning organizations and researchers at U.C. Berkeley. Based on this information, ARB increased the anticipated greenhouse gas emissions reductions for Regional Transportation-Related Greenhouse Gas Targets from 2 to 5 million metric tons of CO_2 equivalent ($MMTCO_2E$).
- In recognition of the importance of local governments in the successful implementation of AB 32, adds a section describing this role and recommends a greenhouse gas emissions reduction target for local government municipal and community-wide emissions of a 15 percent reduction from current levels by 2020 to parallel the State's target.
- Adds four measures to address emissions from industrial sources. These proposed measures would regulate fugitive emissions from oil and gas recovery and gas transmission activities, reduce refinery flaring, and remove the methane exemption for refineries. These proposed measures are anticipated to provide 1.5 $MMTCO_2E$ of greenhouse gas reductions in 2020.
- In consultation with the California Integrated Waste Management Board, re-assesses potential measures in the Recycling and Waste sector. As a result of this assessment, ARB increased the reduction of greenhouse gas emissions that can ultimately be anticipated from the Recycling and Waste Sector from 1 to 10 $MMTCO_2E$, recommending measures to move toward high recycling and zero-waste. Research to help quantify these greenhouse gas emissions is continuing, so only 1 $MMTCO_2E$ of these reductions is currently counted towards the AB 32 goal in this plan.
- Estimates the potential reduction of greenhouse gas emissions from the Green Building sector. Green building systems have the potential to reduce approximately 26 $MMTCO_2E$ of greenhouse gas emissions. Since most of these emissions reductions are counted in the Electricity, Commercial/Residential Energy, Water or Waste sectors, emission reductions in the Green Building sector are not separately counted toward the AB 32 goal.
- Adds a High Global Warming Potential (GWP) Mitigation Fee measure to ensure that the climate impact of these gases is reflected in their price to encourage reduced use and end-of-life losses, as well as the development of alternatives.
- Reduces the expected greenhouse gas emissions reduction from the Heavy-Duty Vehicle Greenhouse Gas Emissions Reduction (Aerodynamic Efficiency) measure and the Tire Inflation measure based on ongoing regulatory

development. The Heavy-Duty Vehicle Greenhouse Gas Emissions Reduction (Aerodynamic Efficiency) measure is now expected to achieve 0.9 $MMTCO_2E$ and the Tire Inflation measure is now expected to achieve 0.4 $MMTCO_2E$.

- Modifies the expected reduction of greenhouse gas emissions from the Low Carbon Fuel Standard to account for potential overlap of benefits with the Pavley greenhouse gas vehicle standards. ARB discounted the expected emission reductions from the Low Carbon Fuel Standard by 10 percent.
- After further evaluation, moves the Heavy-Duty Truck Efficiency measure to the Goods Movement measure. ARB expects that market dynamics will provide an inducement to improve heavy-duty truck efficiency, and reductions in greenhouse gases in the future. ARB would consider pursuing direct requirements to reduce greenhouse gases if truck efficiency does not improve in the future.

B. Background

1. Climate Change Policy in California

California first addressed climate change in 1988 with the passage of AB 4420 (Sher, Chapter 1506, Statutes of 1988). This bill directed the California Energy Commission (CEC) to study global warming impacts to the state and develop an inventory of greenhouse gas emissions sources. In 2000, SB 1771 (Sher, Chapter 1018, Statutes of 2000) established the California Climate Action Registry to allow companies, cities and government agencies to voluntarily record their greenhouse gas emissions in anticipation of a possible program that would allow them to be credited for early reductions.

In 2001, the United Nations' Intergovernmental Panel on Climate Change (IPCC) reported that "there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities." The following year, AB 1493 (Pavley, Chapter 200, Statutes of 2002) was signed into law, requiring ARB to develop regulations to reduce greenhouse gas emissions from passenger vehicles, light-duty trucks and non-commercial vehicles sold in California.

Recognizing the value of regional partners in addressing climate change, the governors of California, Washington, and Oregon created the West Coast Global Warming Initiative in 2003 with provisions for the states to work together on climate change-related programs.

Two years later Governor Schwarzenegger signed Executive Order S-3-05, calling for the State to reduce greenhouse gas emissions to 1990 levels by 2020 and to reduce greenhouse gas emissions to 80 percent below 1990 levels by 2050. The 2020 goal was established to be an aggressive, but achievable, mid-term target, and the 2050 greenhouse gas emissions reduction goal represents the level scientists believe is necessary to reach levels that will stabilize climate.

In 2006, SB 1368 (Perata, Chapter 598, Statutes of 2006) created greenhouse gas performance standards for new long-term financial investments in base-load electricity generation serving California customers. This law is designed to help spur the transition toward cleaner energy in California by placing restrictions on the ability of utilities to build new carbon-intensive plants or enter into new contracts with high carbon sources of electricity. Expiration of existing utility long-term contracts with coal plants will reduce greenhouse gas emissions when such generation is replaced by lower greenhouse gas-emitting resources. These reductions will reduce the need for utilities to submit allowances to comply with the cap-and-trade program.

2. Assembly Bill 32: The Global Warming Solutions Act

In 2006, the Legislature passed and Governor Schwarzenegger signed AB 32, the Global Warming Solutions Act of 2006, which set the 2020 greenhouse gas emissions reduction goal into law. It directed ARB to begin developing discrete early actions to reduce greenhouse gases while also preparing a Scoping Plan to identify how best to reach the 2020 limit. The reduction measures to meet the 2020 target are to become operative by 2012.

AB 32 includes a number of specific requirements for ARB:

- *Identify the statewide level of greenhouse gas emissions in 1990 to serve as the emissions limit to be achieved by 2020 (Health and Safety Code (HSC) §38550).* In December 2007, the Board approved the 2020 emission limit of 427 million metric tons of carbon dioxide equivalent ($MMTCO_2E$) of greenhouse gases.
- *Adopt a regulation requiring the mandatory reporting of greenhouse gas emissions (HSC §38530).* In December 2007, the Board adopted a regulation requiring the largest industrial sources to report and verify their greenhouse gas emissions. The reporting regulation serves as a solid foundation to determine greenhouse gas emissions and track future changes in emission levels.
- *Identify and adopt regulations for Discrete Early Actions that could be enforceable on or before January 1, 2010 (HSC §38560.5).* The Board identified nine Discrete Early Action measures including potential regulations affecting landfills, motor vehicle fuels, refrigerants in cars, port operations and other sources in 2007. The Board has already approved two Discrete Early Action measures (ship electrification at ports and reduction of high GWP gases in consumer products). Regulatory development for the remaining measures is ongoing.
- *Ensure early voluntary reductions receive appropriate credit in the implementation of AB 32 (HSC §38562(b)(3)).* In February 2008, the Board approved a policy statement encouraging voluntary early actions and establishing a procedure for project proponents to submit quantification methods to be evaluated by ARB. ARB, along with California's local air districts and the California Climate Action Registry, is working to implement this program. Voluntary programs are discussed further in Chapter II and in Chapter IV.

- *Convene an Environmental Justice Advisory Committee (EJAC) to advise the Board in developing the Scoping Plan and any other pertinent matter in implementing AB 32 (HSC §38591).* The EJAC has met 12 times since early 2007, providing comments on the proposed Early Action measures and the development of the Scoping Plan, and submitted its comments and recommendations on the draft Scoping Plan in October 2008. ARB will continue to work with The EJAC as AB 32 is implemented.
- *Appoint an Economic and Technology Advancement Advisory Committee (ETAAC) to provide recommendations for technologies, research and greenhouse gas emission reduction measures (HSC §38591).* After a year-long public process, The ETAAC submitted a report of their recommendations to the Board in February 2008. The ETAAC also reviewed and provided comments on the Draft Scoping Plan.

3. Climate Action Team

In addition to establishing greenhouse gas emissions reduction targets for California, Executive Order S-3-05 established the Climate Action Team (CAT) for State agencies in 2005. Chaired by the Secretary of the California Environmental Protection Agency (CalEPA), the CAT has helped to direct State efforts on the reduction of greenhouse gas emissions and engage key State agencies including ARB. The Health and Human Services Agency, represented by the Department of Public Health, is the newest member of the CAT. Based on numerous public meetings and the review of thousands of submitted comments, the CAT released its first report in March 2006, identifying key carbon reduction recommendations for the Governor and Legislature.

Climate Action Team

California Environmental Protection Agency
Business, Transportation, and Housing Agency
Health and Human Services Agency
Resources Agency
State and Consumer Services Agency
Governor's Office of Planning and Research
Air Resources Board
California Energy Commission
California Public Utilities Commission
Department of Food and Agriculture
Department of Forestry and Fire Protection
Department of General Services
Department of Parks and Recreation
Department of Transportation
Department of Water Resources
Integrated Waste Management Board
State Water Resources Control Board

In April 2007, the CAT released a second report, "Proposed Early Actions to Mitigate Climate Change in California," which details numerous strategies that should be initiated prior to the 2012 deadline for other climate action regulations and efforts.

AB 32 recognizes the essential role of the CAT in coordinating overall climate policy. AB 32 does not affect the existing authority of other state agencies, and in addition to

ARB, many state agencies will be responsible for implementing the measures and strategies in this plan. The CAT is central to the success of AB 32, which requires an unprecedented level of cooperation and coordination across State government. The CAT provides the leadership for these efforts and helps ARB work closely with our state partners on the development and implementation of the strategies in the Scoping Plan.

There are currently 12 subgroups within the CAT – nine that address specific economic sectors, and three that were formed to analyze broad issues related to implementing a multi-sector approach to greenhouse gas emissions reduction efforts. The CAT sector-based subgroups include: Agriculture, Cement, Energy, Forest, Green Buildings, Land Use, Recycling and Waste Management, State Fleet, and Water-Energy. The members of these subgroups are drawn from departments that work with or regulate industries in the sector. ARB participated in each of the subgroups. All of the subgroups held public meetings and solicited public input, and many had multiple public workshops.

In March 2008, the subgroups collectively submitted more than 100 greenhouse gas emissions reduction measures to ARB for consideration in the Draft Scoping Plan. Many of those recommendations are reflected in this plan, and a number of them focus on reducing greenhouse gas emissions from energy production and use.

Through the Energy Subgroup the California Energy Commission (CEC) and the California Public Utilities Commission (CPUC) are conducting a joint proceeding to provide recommendations on how best to address electricity and natural gas in the implementation of AB 32, including evaluation of how the Electricity sector might best participate in a cap-and-trade program. The two Commissions forwarded interim recommendations to ARB in March 2008 that supported inclusion of the Electricity sector in a multi-sector cap-and-trade program, and measures to increase the penetration of energy efficiency programs in both buildings and appliances and to increase renewable energy sources. The two Commissions have developed a second proposed decision that was released in September 2008. This proposed decision provides more detailed recommendations that relate to the electricity and natural gas sectors. Because implementation of the Scoping Plan will require careful coordination with the State's energy policy, ARB will continue working closely with the two Commissions on this important area during the implementation of the recommendations in the Scoping Plan.

There are also three subgroups which are not sector-specific. The Economic Subgroup reviewed cost information associated with potential measures that were included in the 2006 CAT report with updates reflected in the report, "Updated Macroeconomic Analysis of Climate Strategies," in October 2007. This report provided an update of the macroeconomic analysis presented in the March 2006 CAT report to Governor Schwarzenegger and the Legislature. The Research Subgroup coordinates climate change research and identifies opportunities for collaboration, and is presently working on a report to the Governor. The State Operations Subgroup

has been created to work with State agencies to create a statewide plan to reduce State government's greenhouse gas emissions by a minimum of 30 percent by 2020.

In the first quarter of 2009, the Climate Action Team will release a report on its activities outside of its involvement in the development of the Scoping Plan. The CAT report will focus on several cross-cutting topics with which members of the CAT have been involved since the publication of the 2006 CAT report. The topics to be covered include research on the physical and consequent economic impacts of climate change as well as climate change research coordination efforts among the CAT members. There will also be an update on the important climate change adaptation efforts led by the Resources Agency and a discussion of cross-cutting issues related to environmental justice concerns. The CAT report will be released in draft form and will be available for public review in December 2008.

4. Development of the Greenhouse Gas Emission Reduction Strategy

In developing the Scoping Plan, ARB considered the State's existing climate change policy initiatives and the Early Action measures identified by the Board. Several advisory groups were formed to assist ARB in developing the Scoping Plan, including the Environmental Justice Advisory Committee (EJAC), the Economic and Technology Advancement Committee (ETAAC), and the Market Advisory Committee (MAC).

The Environmental Justice Advisory Committee (HSC §38591(a) et seq) advises ARB on development of the Scoping Plan and any other pertinent matter in implementing AB 32. The Board appoints its members, based on nominations received from environmental justice organizations and community groups.

The Economic and Technology Advancement Advisory Committee (HSC §38591(d)) includes members who are appointed by the Board based on expertise in fields of business, technology research and development, climate change, and economics. The ETAAC advises ARB on activities that will facilitate investment in, and implementation of, technological research and development opportunities, funding opportunities, partnership development, technology transfer opportunities, and related areas that lead to reductions of greenhouse gas emissions.

Members of the Market Advisory Committee (created under Executive Order S-20-06) were appointed by the Secretary of CalEPA based on their expertise in economics and climate change. The MAC advised ARB on the design of a cap-and-trade program for reducing greenhouse gas emissions.

Along with input from the advisory groups, ARB received submittals to a public solicitation for ideas, and numerous comments during public workshops, workgroup meetings, community meetings, and meetings with stakeholder groups. ARB held numerous workshops on the Draft Scoping Plan and convened workgroup meetings focused on program design and economic analysis. ARB and other involved State

agencies also held sector-specific technical workshops to look in greater detail at potential emissions reduction measures.

ARB also looked outward to examine programs at the regional, national and international levels. ARB met with and learned from experts from the European Union, the United Kingdom, Japan, Australia, the United Nations, the Regional Greenhouse Gas Initiative, the RECLAIM program, and the U.S. Environmental Protection Agency (U.S. EPA).

After the release of the Draft Scoping Plan, ARB conducted workshops and community meetings around the state to solicit public input. The Environmental Justice Advisory Committee and the Economic and Technology Advancement Advisory Committee held meetings to review and provide additional comments on the Draft Scoping Plan. In addition, ARB held meetings with numerous stakeholder groups to discuss specific greenhouse gas emissions reduction measures.

As described before, ARB has reviewed and considered both the written comments and the verbal comments received at the public workshops and meetings with stakeholders. This input, along with additional analysis, has ultimately shaped this Scoping Plan.

5. Implementation of the Scoping Plan

The foundation of the Scoping Plan's strategy is a set of measures that will cut greenhouse gas emissions by nearly 30 percent by the year 2020 as compared to business as usual and put California on a course for much deeper reductions in the long term. In addition to pursuing the reduction of greenhouse gas emissions, other strategies to mitigate climate change, such as carbon capture and storage (underground geologic storage of carbon dioxide), should also be further explored. And, as greenhouse gas reduction measures are implemented, we will continually evaluate how these measures can be optimized to also help deliver a broad range of public health benefits.

Most of the measures in this Scoping Plan will be implemented through the full rulemaking processes at ARB or other agencies. These processes will provide opportunity for public input as the measures are developed and analyzed in more detail. This additional analysis and public input will likely provide greater certainty about the estimates of costs and expected greenhouse gas emission reductions, as well as the design details that are described in this Scoping Plan. With the exception of Discrete Early Actions, which will be in place by January 1, 2010, other regulations are expected to be adopted by January 1, 2011 and take effect at the beginning of 2012.

Some of the measures in the plan may deliver more emission reductions than we expect; others less. It is also very likely that we will figure out new and better ways to cut greenhouse gas emissions as we move forward. New technologies will no doubt be developed, and new ideas and strategies will emerge. The Scoping Plan puts

California squarely on the path to a clean energy future but it also recognizes that adjustments will probably need to occur along the way and that as additional tools become available they will augment, and in some cases perhaps even replace, existing approaches.

California will not be implementing the measures in this Plan in a vacuum. Significant new action on climate policy is likely at the federal level and California and its partners in the Western Climate Initiative are working together to create a regional effort for achieving significant reductions of greenhouse gas emissions throughout the western United States and Canada. California is also developing a state Climate Adaptation Strategy to reduce California's vulnerability to known and projected climate change impacts.

ARB and other State agencies will continue to monitor, lead and participate in these broader activities. ARB will adjust the measures described here as necessary to ensure that California's program is designed to facilitate the development of integrated and cost-effective regional, national, and international greenhouse gas emissions reduction programs. (HSC §38564)

6. Climate Change in California

The impacts of climate change on California and its residents are occurring now. Of greater concern are the expected future impacts to the state's environment, public health and economy, justifying the need to sharply cut greenhouse gas emissions.

In the Findings and Declarations for AB 32, the Legislature found that:

> "The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to the marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other health-related problems."

The Legislature further found that global warming would cause detrimental effects to some of the state's largest industries, including agriculture, winemaking, tourism, skiing, commercial and recreational fishing, forestry, and the adequacy of electrical power.

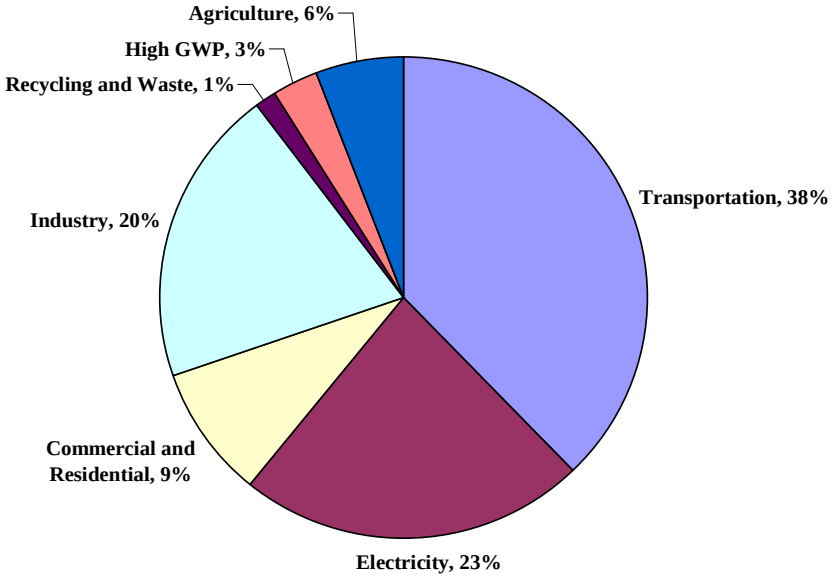
The impacts of global warming are already being felt in California. The Sierra snowpack, an important source of water supply for the state, has shrunk 10 percent in the last 100 years. It is expected to continue to decrease by as much as 25 percent by 2050. World-wide changes are causing sea levels to rise – about 8 inches of increase has been recorded at the Golden Gate Bridge over the past 100 years – threatening low coastal areas with inundation and serious damage from storms.

C. California's Greenhouse Gas Emissions and the 2020 Target

California is the fifteenth largest emitter of greenhouse gases on the planet, representing about two percent of the worldwide emissions. Although carbon dioxide is the largest contributor to climate change, AB 32 also references five other greenhouse gases: methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). Many other gases contribute to climate change and would also be addressed by measures in this Scoping Plan.

Figure 1 and Table 1 show 2002 to 2004 average emissions and estimates for projected emissions in 2020 without any greenhouse gas reduction measures (business-as-usual case). The 2020 business-as-usual forecast does not take any credit for reductions from measures included in this Plan, including the Pavley greenhouse gas emissions standards for vehicles, full implementation of the Renewables Portfolio Standard beyond current levels of renewable energy, or the solar measures. Additional information about the assumptions in the 2020 forecast is provided in Appendix F.

Figure 1: California's Greenhouse Gas Emissions (2002-2004 Average)[14]



As seen in Figure 1, the Transportation sector – largely the cars and trucks that move goods and people – is the largest contributor with 38 percent of the state's total greenhouse gas emissions. Table 1 shows that if we take no action, greenhouse gas emissions in the

[14] Air Resources Board. Greenhouse Gas Inventory. http://www.arb.ca.gov/cc/inventory/inventory.htm (accessed October 12, 2008)

Transportation sector are expected to grow by approximately 25 percent by 2020 (an increase of 46 $MMTCO_2E$).

The Electricity and Commercial/Residential Energy sector is the next largest contributor with over 30 percent of the statewide greenhouse gas emissions. Although electricity imported into California accounts for only about a quarter of our electricity, imports contribute more than half of the greenhouse gas emissions from electricity because much of the imported electricity is generated at coal-fired power plants. AB 32 specifically requires ARB to address emissions from electricity sources both inside and outside of the state.

California's Industrial sector includes refineries, cement plants, oil and gas production, food processors, and other large industrial sources. This sector contributes almost 20 percent of California's greenhouse gas emissions, but the sector's emissions are not projected to grow significantly in the future. The sector termed recycling and waste management is a unique system, encompassing not just emissions from waste facilities but also the emissions associated with the production, distribution and disposal of products throughout the economy.

Although high global warming potential (GWP) gases are a small contributor to historic greenhouse gas emissions, levels of these gases are projected to increase sharply over the next several decades, making them a significant source by 2020.

The Forest sector is unique in that forests both emit greenhouse gases and uptake carbon dioxide (CO_2). While the current inventory shows forests as a sink of 4.7 $MMTCO_2E$, carbon sequestration has declined since 1990. For this reason, the 2020 projection assumes no net emissions from forests.

The agricultural greenhouse gas emissions shown are largely methane emissions from livestock, both from the animals and their waste. Emissions of greenhouse gases from fertilizer application are also important contributors from the Agricultural sector. ARB has begun a research program to better understand the variables affecting these emissions. Opportunities to sequester CO_2 in the Agricultural sector may also exist; however, additional research is needed to identify and quantify potential sequestration benefits.

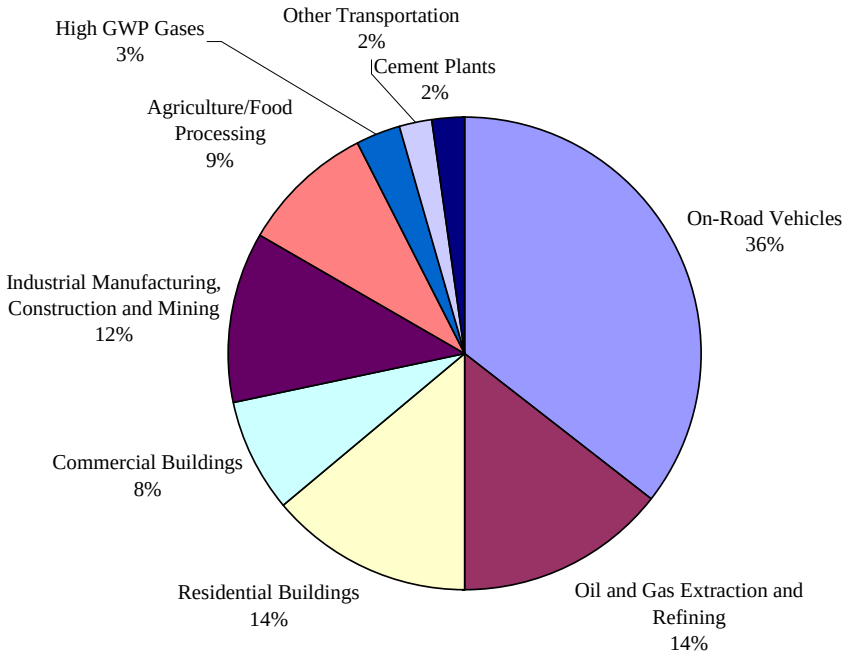
In December 2007, ARB approved a greenhouse gas emissions target for 2020 equivalent to the state's calculated greenhouse gas emissions level in 1990. ARB developed the 2020 target after extensive technical work and a series of stakeholder meetings. The 2020 target of 427 $MMTCO_2E$ requires the reduction of 169 $MMTCO_2E$, or approximately 30 percent, from the state's projected 2020 emissions of 596 $MMTCO_2E$ (business-as-usual) and the reduction of 42 $MMTCO_2E$, or almost 10 percent, from 2002-2004 average emissions.

Table 1: 2002-2004 Average Emissions and 2020 Projected Emissions (Business-as-Usual)[15]
($MMTCO_2E$)

Sector	2002-2004 Average Emissions	Projected 2020 Emissions [BAU]
Transportation	179.3	225.4
Electricity	109.0	139.2
Commercial and Residential	41.0	46.7
Industry	95.9	100.5
Recycling and Waste	5.6	7.7
High GWP	14.8	46.9
Agriculture	27.7	29.8
Forest Net Emissions	-4.7	0.0
Emissions Total	**469**	**596**

Figure 2 presents California's historic greenhouse gas emissions in a different way – based not on the source of the emissions, but on the end use. This chart highlights the importance of addressing on-road transportation sources of greenhouse gas emissions, as well as the significant contribution from the heating, cooling, and lighting of buildings.

Figure 2: California's Greenhouse Gas Emissions – A Demand-Side View –



[15] Ibid.

The data shown in this section provide two ways to look at California's greenhouse gas profile – emissions-based and end use (demand side)-based. While it is possible to illustrate the inventory many different ways, no chart or graph can fully display how diverse economic sectors fit together. California's economy is a web of activity where seemingly independent sectors and subsectors operate interdependently and often synergistically. For example, reductions in water use reduce the need to pump water, directly lowering electricity use and associated greenhouse gas emissions. Similarly, reducing the generation of waste reduces the need to transport the waste to landfills – lowering transportation emissions and, possibly, landfill methane emissions. Increased recycling or re-use reduces the carbon emissions embedded in products – it takes less energy to make a soda can made from recycled aluminum than from virgin feedstock.

The measures included in this Scoping Plan are identified discretely, but many impact each other, and changes in one measure can directly overlap and have a ripple effect on the efficacy and success of other measures. The measures and policies outlined in this Plan reflect these interconnections, and highlight the need for all agencies to work collaboratively to implement the Scoping Plan.

II. RECOMMENDED ACTIONS

Achieving the goals of AB 32 in a cost-effective manner will require a wide range of approaches. Every part of California's economy needs to play a role in reducing greenhouse gas emissions. ARB's comprehensive greenhouse gas emissions inventory lists emission sources ranging from the largest refineries and power plants to small industrial processes and farm livestock. The recommended measures were developed to reduce greenhouse gas emissions from key sources and activities while improving public health, promoting a cleaner environment, preserving our natural resources, and ensuring that the impacts of the reductions are equitable and do not disproportionately impact low-income and minority communities. These measures also put the state on a path to meet the long-term 2050 goal of reducing California's greenhouse gas emissions to 80 percent below 1990 levels. This trajectory is consistent with the reductions that are needed globally to help stabilize the climate. While the scale of this effort is considerable, our experience with cultural and technological changes makes California well-equipped to handle this challenge.

ARB evaluated a comprehensive array of approaches and tools to achieve these emission reductions. Reducing greenhouse gas emissions from the wide variety of sources can best be accomplished though a cap-and-trade program along with a mix of complementary strategies that combine market-based regulatory approaches, other regulations, voluntary measures, fees, policies, and programs. ARB will monitor implementation of these measures to ensure that the State meets the 2020 limit on greenhouse gas emissions.

An overall limit on greenhouse gas emissions from most of the California economy – the "capped sectors" – will be established by the cap-and-trade program. (The basic elements of the cap-and-trade program are described later in this chapter.) Within the capped sectors, some of the reductions will be accomplished through direct regulations such as improved building efficiency standards and vehicle efficiency measures. Whatever additional reductions are needed to bring emissions within the cap are accomplished through price incentives posed by emissions allowance prices. Together, direct regulation and price incentives assure that emissions are brought down cost-effectively to the level of the overall cap. ARB also recommends specific measures for the remainder of the economy – the "uncapped sectors."

Key elements of California's recommendations for reducing its greenhouse gas emissions to 1990 levels by 2020 include:

- **Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;**
- **Achieving a statewide renewables energy mix of 33 percent;**
- **Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system;**
- **Establishing targets for transportation-related greenhouse gas emissions for regions throughout California and pursuing policies and incentives to achieve those targets;**
- **Adopting and implementing measures pursuant to existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard; and**
- **Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the State's long-term commitment to AB 32 implementation.**

The recommended greenhouse gas emissions reduction measures are listed in Table 2 and are summarized in Section C below. The total reduction for the recommended measures slightly exceeds the 169 $MMTCO_2E$ of reductions estimated in the Draft Scoping Plan. This is the net effect of adding several measures and adjusting the emission reduction estimates for some other measures. The 2020 emissions cap in the cap-and-trade program is preserved at the same level as in the Draft Scoping Plan (365 $MMTCO_2E$).

The measures listed in Table 2 lead to emissions reductions from sources within the capped sectors (146.7 $MMTOCO_2E$) and from sources or sectors not covered by cap-and-trade (27.3 $MMTCO_2E$). As mentioned, within the capped sectors the reductions derive both from direct regulation and from the incentives posed by allowance prices. Further discussion of how the cap-and-trade program and the complementary measures work together to achieve the overall target is provided below.

Table 2 also lists several other recommended measures which will contribute toward achieving the 2020 statewide goal, but whose reductions are not (for various reasons including the potential for double counting) additive with the other measures. Those measures and the basis for not including their reductions are further discussed in Section C.

Table 2: Recommended Greenhouse Gas Reduction Measures

Recommended Reduction Measures	Reductions Counted Towards 2020 Target ($MMTCO_2E$)	
ESTIMATED REDUCTIONS RESULTING FROM THE COMBINATION OF CAP-AND-TRADE PROGRAM AND COMPLEMENTARY MEASURES		**146.7**
California Light-Duty Vehicle Greenhouse Gas Standards • Implement Pavley standards • Develop Pavley II light-duty vehicle standards	31.7	
Energy Efficiency • Building/appliance efficiency, new programs, etc. • Increase CHP generation by 30,000 GWh • Solar Water Heating (AB 1470 goal)	26.3	
Renewables Portfolio Standard (33% by 2020)	21.3	
Low Carbon Fuel Standard	15	
Regional Transportation-Related GHG Targets[16]	5	
Vehicle Efficiency Measures	4.5	
Goods Movement • Ship Electrification at Ports • System-Wide Efficiency Improvements	3.7	
Million Solar Roofs	2.1	
Medium/Heavy Duty Vehicles • Heavy-Duty Vehicle Greenhouse Gas Emission Reduction (Aerodynamic Efficiency) • Medium- and Heavy-Duty Vehicle Hybridization	1.4	
High Speed Rail	1.0	
Industrial Measures (for sources covered under cap-and-trade program) • Refinery Measures • Energy Efficiency & Co-Benefits Audits	0.3	
Additional Reductions Necessary to Achieve the Cap	34.4	
ESTIMATED REDUCTIONS FROM UNCAPPED SOURCES/SECTORS		**27.3**
High Global Warming Potential Gas Measures	20.2	
Sustainable Forests	5.0	
Industrial Measures (for sources not covered under cap and trade program) • Oil and Gas Extraction and Transmission	1.1	
Recycling and Waste (landfill methane capture)	1.0	
TOTAL REDUCTIONS COUNTED TOWARDS 2020 TARGET		**174**
Other Recommended Measures	**Estimated 2020 Reductions ($MMTCO_2E$)**	
State Government Operations	1-2	
Local Government Operations	TBD	
Green Buildings	26	
Recycling and Waste • Mandatory Commercial Recycling • Other measures	9	
Water Sector Measures	4.8	
Methane Capture at Large Dairies	1.0	

[16] This number represents an estimate of what may be achieved from local land use changes. It is not the SB 375 regional target. ARB will establish regional targets for each Metropolitan Planning Organization (MPO) region following the input of the Regional Targets Advisory Committee and a public consultation process with MPOs and other stakeholders per SB 375.

The development of a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system is a central feature of the overall recommendation. This program will lead to prices on greenhouse gas emissions, prices that will spur reductions in greenhouse gas emissions throughout the California economy, through application of existing technologies and through the creation of new technological and organizational options. The rationale for combining a cap-and-trade program with complementary measures was outlined by the Market Advisory Committee, which noted the following in its recommendations to the ARB:

> Before setting out the key design elements of a cap-and-trade program it is important to explain how the proposed emissions trading approach relates to other policy measures. The following considerations seem especially relevant:
>
> - The emissions trading program puts a cap on the total emissions generated by facilities covered under the system. Because a certain number of emissions allowances are put in circulation in each compliance period, this approach provides a measure of certainty about the total quantity of emissions that will be released from entities covered under the program.
> - The market price of emissions allowances yields an enduring price signal for GHG emissions across the economy. This price signal provides incentives for the market to find new ways to reduce emissions.
> - By itself, a cap-and-trade program alone will not deliver the most efficient mitigation outcome for the state. There is a strong economic and public policy basis for other policies that can accompany an emissions trading system. [17]

The Economic and Technology Advancement Advisory Committee (ETAAC) also addressed the benefits associated with a combined policy of cap and trade and complementary measures.

> A declining cap can send the right price signals to shape the behavior of consumers when purchasing products and services. It would also shape business decisions on what products to manufacture and how to manufacture them. Establishing a price for carbon and other GHG emissions can efficiently tilt decision-making toward cleaner alternatives. This cap and trade approach (complemented by technology-forcing performance standards) avoids the danger of having government or other centralized decision-makers choose specific technologies, thereby limiting the flexibility to allow other options to emerge on a level playing field.

[17] Recommendations of the Market Advisory Committee to the California Air Resources Board. *Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California*. June 30, 2007. p. 19. http://www.climatechange.ca.gov/publications/market_advisory_committee/2007-06-29_MAC_FINAL_REPORT.PDF (accessed October 12, 2008)

> If markets were perfect, such a cap and trade system would bring enough new technologies into the market and stimulate the necessary industrial RD&D to solve the climate change challenge in a cost effective manner. As the Market Advisory Committee notes, however, placing a price on GHG emissions addresses only one of many market failures that impede solutions to climate change. Additional market barriers and co-benefits would not be addressed if a cap and trade system were the only state policy employed to implement AB 32. Complementary policies will be needed to spur innovation, overcome traditional market barriers (e.g., lack of information available to energy consumers, different incentives for landlords and tenants to conserve energy, different costs of investment financing between individuals, corporations and the state government, etc.) and address distributional impacts from possible higher prices for goods and services in a carbon-constrained world.[18]

The Environmental Justice Advisory Committee (EJAC) also supports an approach that includes a price on carbon along with complementary measures. Although the EJAC recommends that the carbon price be established through a carbon fee rather than through a cap-and-trade program, they recognize the importance of mutually supportive policies:

> California should establish a three-pronged approach for addressing greenhouse gases: (1) adopting standards and regulations; (2) providing incentives; and (3) putting a price on carbon via a carbon fee. The three pieces support one another and no single prong can work without equally robust support from the others.[19]

In keeping with the rationale outlined above, ARB finds that it is critically important to include complementary measures directed at emission sources that are included in the cap-and-trade program. These measures are designed to achieve cost-effective emissions reductions while accelerating the necessary transition to the low-carbon economy required to meet the 2050 target:

- The already adopted Light-Duty Vehicle Greenhouse Gas Standards are designed to accelerate the introduction of low-greenhouse gas emitting vehicles, reduce emissions and save consumers money at the pump.
- The Low Carbon Fuel Standard (LCFS) is a flexible performance standard designed to accelerate the availability and diversity of low-carbon fuels by taking into consideration the full life-cycle of greenhouse gas emissions. The LCFS will reduce emissions and make our economy more resilient to future petroleum price volatility.
- The Regional Transportation-Related Greenhouse Gas Targets provide incentives for channeling investment into integrated development patterns and transportation

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[18] Recommendations of the Economic and Technical Advancement Advisory Committee (ETAAC), Final Report. *Technologies and Policies to Consider for Reducing Greenhouse Gas Emissions in California*. February 14, 2008. pp. 1-4 http://www.arb.ca.gov/cc/etaac/ETAACFinalReport2-11-08.pdf (accessed October 12, 2008)

[19] Recommendations and Comments of the Environmental Justice Advisory Committee on the Implementation of the Global Warming Solutions Act of 2006 (AB32) on the Draft Scoping Plan. October 2008. p. 10. http://www.arb.ca.gov/cc/ejac/ejac_comments_final.pdf (accessed October 12, 2008)

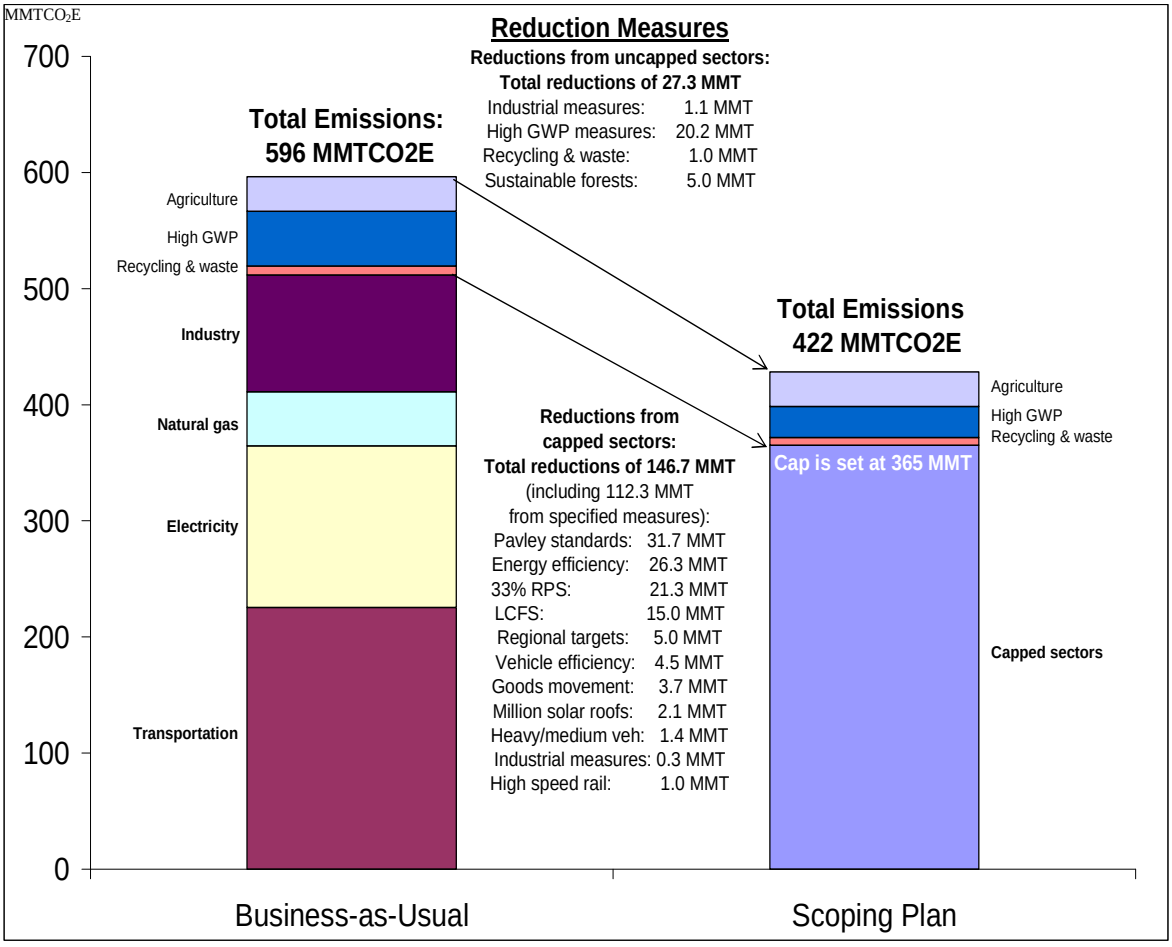
infrastructure, through improved planning. Improved planning and the resulting development are essential for meeting the 2050 emissions target.

- In the Energy sector, measures will provide better information and overcome institutional barriers that slow the adoption of cost-effective energy efficiency technologies. Enhanced energy efficiency programs will provide incentives for customers to purchase and install more efficient products and processes, and building and appliance standards will ensure that manufacturers and builders bring improved products to market.
- The Renewables Portfolio Standard (RPS) promotes multiple objectives, including diversifying the electricity supply. Increasing the RPS to 33 percent is designed to accelerate the transformation of the Electricity sector, including investment in the transmission infrastructure and system changes to allow integration of large quantities of intermittent wind and solar generation.
- The Million Solar Roofs Initiative uses incentives to transform the rooftop solar market by driving down costs over time.
- The Goods Movement program is primarily intended to achieve criteria and toxic air pollutant reductions but will provide important greenhouse gas benefits as well.
- Similar to the light duty vehicle greenhouse gas standards, the heavy duty and medium duty vehicle measures and the additional light duty vehicle efficiency measures aim to achieve cost-effective reductions of GHG emissions and save fuel.

Each of these complementary measures helps to position the California economy for the future by reducing the greenhouse gas intensity of products, processes, and activities. When combined with the absolute and declining emissions limit of the cap-and-trade program, these policies ensure that we cost-effectively achieve our greenhouse gas emissions goals and set ourselves on a path towards a clean low carbon future.

Figure 3 illustrates how the recommended emission reduction measures together put California on a path toward achieving the 2020 goal. The left hand column in Figure 3 shows total projected business as usual emissions in 2020, by sector (596 $MMTCO_2E$). The right hand column shows 2020 emissions after applying the Scoping Plan recommended reduction measures (422 $MMTCO_2E$). The measures that accomplish the needed reductions are listed in between the columns. As Figure 3 shows, there are a total of 27.3 $MMTCO_2E$ in reductions from uncapped sectors, and 146.7 $MMTCO_2E$ in reductions from capped sectors.

Figure 3: California Greenhouse Gas Emissions in 2020 and Recommended Reduction Measures



The recommended cap-and-trade program provides covered sources with the flexibility to pursue low cost reductions. It is important to recognize, however, that other recommended measures also provide compliance flexibility. As is often the case with ARB regulations, many of the measures establish performance standards and allow regulated entities to determine how best to achieve the required emission level. This approach rewards innovation and allows facilities to take advantage of the best way to meet the overarching environmental objective.

Table 3 lists the proposed measures that include compliance flexibility or market mechanisms. This flexibility ranges from the potential for tradable renewable energy credits in the Renewables Portfolio Standard to the incentives to encourage emission reductions in electricity and natural gas efficiency programs to the averaging, banking and trading mechanisms in the Pavley and Low Carbon Fuel Standard programs to a multi-sector cap-and-trade program.

Table 3: Measures With Flexible Market Compliance Features

Measure	Estimated Reductions
Additional Reductions from Capped Sectors	34.4
California Light-Duty Vehicle Greenhouse Gas Standards (Pavley I & II)	31.7
Renewables Portfolio Standard	21.3
Electricity Efficiency	15.2
Low Carbon Fuel Standard	15.0
Mitigation Fee on High GWP Gases	5.0
Natural Gas Efficiency	4.3
Goods Movement Systemwide Efficiency	3.5
Medium/Heavy Duty Vehicle Hybridization	0.5
Total	**130.9**

The recommended mix of measures builds on a strong foundation of previous action in California to address climate change and broader environmental issues. The program recommended here relies on implementing existing laws and regulations that were adopted to reduce greenhouse gas emissions and other policy goals; strengthening and expanding existing programs; implementing the discrete early actions adopted by the Board in 2007; and new measures developed during the Scoping Plan process itself.

The mix of measures recommended in this Plan provides a comprehensive approach to reduce emissions to achieve the 2020 target, and to initiate the transformations required to achieve the 2050 target. The cap-and-trade program and complementary measures will cover about 85 percent of greenhouse gas emissions throughout California's economy. ARB recognizes that due to several factors, including information discovered during regulatory development, technology maturity, and implementation challenges, actual reductions from individual measures aimed at achieving the 2020 target may be higher or lower than current estimates. The inclusion of many of these emissions within the cap-and-trade program, along with a margin of safety in the uncapped sectors, will help ensure that the 2020 target is met. The combination of approaches provides certainty that the overall program will meet the target despite some degree of uncertainty in the estimates for any individual measure. Additionally, by internalizing the cost of CO_2E emissions throughout the economy, the cap-and-trade program supports the complementary measures and provides further incentives for innovation and continuing emissions reductions from energy producers and consumers setting us on a path toward our 2050 goals.

Some emissions sources are not currently suitable for inclusion in the cap-and-trade program due to challenges associated with precise measurement, tracking or sector structure. For these emissions sources, ARB is including measures designed to focus on waste management, agriculture, forestry, and certain emissions of high GWP gases, a rapidly growing component of California's greenhouse gas emissions inventory.

California's economy is expected to continue to experience robust growth through 2020. Economic modeling, including evaluation of the effects on low-income Californians, shows that the measures included within this Scoping Plan can be implemented with a net positive effect on California's long-term economic growth. The evaluation of related public health and environmental benefits of the various measures also shows that implementation will result in not only reduced greenhouse gas emissions and improved public health, but also in a beneficial effect on California's environment. The results of these evaluations are presented in Chapter III.

AB 32 includes specific criteria that ARB must consider before adopting regulations for market-based compliance mechanisms to implement a greenhouse gas reduction program, and directs the Board, to the extent feasible, to design market-based compliance mechanisms to prevent any increase in the emissions of toxic air contaminants or criteria air pollutants. In the development of regulations that contain market mechanisms, ARB will consider the economic, environmental and public health effects, and the evaluation of potential localized impacts. These results will be used to institute appropriate economic, environmental and public health safeguards.

ARB has also designed the recommendation to ensure that reductions will come from throughout the California economy. Transportation accounts for the largest share of California's greenhouse gas emissions. Accordingly, a large share of the reduction of greenhouse gas emissions from the recommended measures comes from this sector. Measures include the inclusion of transportation fuels in the cap-and-trade program, the Low Carbon Fuel Standard to reduce the carbon intensity of transportation fuels, enforcement of regulations that reduce greenhouse gas emissions from vehicles, and policies to reduce transportation emissions by changes in future land use patterns and community design as well as improvements in public transportation.

In the Energy sector, the recommended measures increase the amount of electricity from renewable energy sources, and improve the energy efficiency of industries, homes and buildings. The inclusion of these sectors and the Industrial sector in the cap-and-trade program provides further assurance that significant cost-effective reductions will be achieved from the sectors that contribute the greatest emissions. Additional energy production from renewable resources may also rely on measures suggested in the Agriculture, Water, and the Recycling and Waste Management Sectors.

Other sectors are also called upon to cut emissions. The cap-and-trade program covers industrial sources and natural gas use. The recommended measures would require industrial processes to examine how to lower their greenhouse gas emissions and be more energy efficient, and would require goods movement operations through California's ports to be more energy efficient. Other measures address waste management, agricultural and forestry practices, as well as the transport and treatment of water throughout the state. Finally, the recommended measures address ways to reduce or eliminate the emissions of high global warming potential gases that, on a per-ton basis, contribute to global warming at a level many times greater than carbon dioxide.

As the Scoping Plan is implemented, ARB and other agencies will coordinate with the Green Chemistry Initiative, particularly in the Green Building and Recycling/Waste sectors. Green Chemistry is a fundamentally new approach to environmental protection that emphasizes environmental protection at the design stage of product and manufacturing processes, rather than focusing on end-of-pipe or end-of-life activities, or a single environmental medium, such as air, water or soil. This new approach will reduce the use of harmful chemicals, generate less waste, use less energy, and, accordingly, will contribute toward California's greenhouse gas reduction goals.

A. The Role of State Government: Setting an Example

For many years California State government has successfully incorporated environmental principles in managing its resources and running its business. The Governor has directed State agencies to sharply reduce their building-related energy use and encouraged our State-run pensions to invest in energy efficient and clean technologies.[20] The State also has been active in procuring low-emission, alternative fuel vehicles in its large fleet.

While State government has already accomplished much to reduce its greenhouse gas emissions, it can and must do more. State agencies must lead by example by continuing to reduce their greenhouse gas emissions. Therefore, California State government has established a target of reducing its greenhouse gas emissions by a *minimum* of 30 percent below its estimated business-as-usual emissions by 2020 – approximately a 15 percent reduction from current levels.

As an owner-operator of key infrastructure, State government has the ability to ensure that the most advanced, cost-effective environmental performance requirements are used in the design, construction, and operation of State facilities. As a purchaser with significant market power, State government has the ability to demand that the products and services it procures contribute positively toward California's targets to reduce greenhouse gas emissions, such as through the efforts of Environmentally Preferable Purchasing. As an investor of more than $400 billion,[21] State government has the ability to prioritize low-carbon investments. With more than 350,000 employees, State government is uniquely situated to adopt and implement policies that give State workers the ability to decrease their individual carbon impact, including encouraging siting facilities within communities to enhance balance in jobs and housing, encouraging carpooling, biking, walking, telecommuting, the use of public transit, and the use of alternative work schedules.

[20]Governor Schwarzenegger signed Executive Order Executive Order S-20-04 on December 14, 2004. This Order contains a number of directives, including a set of aggressive goals for reducing state building energy use and requested the California Public Employees Retirement System (CalPERS) and the California State Teachers Retirement System (CalSTRS) to target resource-efficient buildings for real estate investments and commit funds toward clean, efficient and sustainable technologies.

[21] CalPERS and CalSTRS are the two largest pension systems in the nation with investments in excess of $400 billion as of August 2008.

Myriad opportunities exist for California State government to operate more efficiently. These opportunities will not only reduce greenhouse gas emissions but also will produce savings for California taxpayers. Initiatives now underway that will contribute to the State government reduction target include the Governor's Green Building Initiative and the Department of General Services' efforts to increase the number of fuel-efficient vehicles in the State fleet.

Major efforts to expand renewable energy use and divest from coal-fired power plants are currently underway. Together with energy conservation and efficiency strategies on water projects, roadways, parks, and bridges, these efforts all play major roles in reducing the State's greenhouse gas emissions. State agencies should review their travel practices and make greater use of teleconferencing and videoconferencing to reduce the need for business travel, particularly air travel.

State agencies are now examining their policies and operations to determine how they can reduce their greenhouse gas emissions. These findings will be instrumental as each cabinet-level agency registers with the California Climate Action Registry (CCAR) to record and report their individual carbon footprints. The Climate Action Team has created a new State Government Operations sub-group that will work closely with the agencies to review the results of their evaluations and the CCAR reports to determine how best to achieve the maximum reductions possible.

State agencies must take the lead in driving this low-carbon economy by reducing their own emissions, and also by serving as a catalyst for local government and private sector activity. New "Best Practices" implemented by State agencies can be transferred to other entities within California, the nation, and internationally. By increasing cooperation and coordination across organizational boundaries, State government will maximize the experience and contributions of each agency involved to achieve the 30 percent reduction of greenhouse gas emissions while growing the economy and protecting the environment.

State government's impact on emissions goes far beyond its own buildings, vehicles, projects, and employees. State government casts a sizable "carbon shadow"– that is, the climate change impact of legislative, executive, and financial actions of State agencies that affect Californians now and in the future. For example, the California Energy Commission (CEC) recently initiated a proceeding to consider how to align its permitting process with the State's greenhouse gas and renewable energy policy goals. ARB intends to work closely with the CEC during this proceeding. New power plants, both fossil-fuel fired and renewable generation, will be a critical part of the state's electricity mix in coming decades. The investments that are made in this new infrastructure in the next several years will become part of the backbone of the state's electricity supply for decades to come. This timely investigation will be a critical element of California's ability to meet the AB 32 emissions reduction target for 2020, the ambitious target set by the Governor for 2050, and also the specific goal of achieving 33 percent renewables in the state's electricity mix. The Governor's Office of Planning and Research and the Resources Agency are developing proposed amendments to the California Environmental Quality Act (CEQA) Guidelines to

provide guidance on how to address greenhouse gases in CEQA documents. As required by SB 97 (Chapter 185, Statutes of 2007), the amended CEQA guidelines will be adopted by January 1, 2010.

In addition, agencies such as the California Labor and Workforce Development Agency, the Business, Transportation and Housing Agency and the newly created Green Collar Jobs Council (AB 3018, Chapter 312, Statutes of 2008) are dedicated to economic development, training, safety, labor relations, and employment development throughout the State. ARB will coordinate with the Council and also with other State agencies to address workforce needs and facilitate a smooth transition to California's emerging low-carbon economy that maximizes economic development and employment opportunities in California.

The State expends funds to provide services to California residents – from preserving our natural resources to building and maintaining infrastructure like roads, bridges and dams. California residents should reap all of the benefits of these projects, including any associated quantifiable and marketable reductions in greenhouse gas emissions. Because of this, California should retain ownership of these greenhouse gas emissions reductions and use them to promote the goals of AB 32 and other goals of the state.

California State government can also lead through example by aligning its efforts to reduce greenhouse gas emissions with efforts to protect and improve public health. As a new member of the Climate Action Team, the Department of Public Health will help ensure that measures to combat global warming also incorporate public health protection and improvement strategies. As discussed below, these and many other State leadership efforts can be built upon at the local level as well.

B. The Role of Local Government: Essential Partners

Local governments are essential partners in achieving California's goals to reduce greenhouse gas emissions. They have broad influence and, in some cases, exclusive authority over activities that contribute to significant direct and indirect greenhouse gas emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations. Many of the proposed measures to reduce greenhouse gas emissions rely on local government actions.

Over 120 California cities have already signed on to the U.S. Conference of Mayors Climate Protection Agreement. In addition, over 30 California cities and counties have committed to developing and implementing Climate Action Plans. Many local governments and related organizations have already begun educating Californians on the benefits of energy efficiency measures, public transportation, solar homes, and recycling. These communities have not only demonstrated courageous leadership in taking initiative to reduce greenhouse gas emissions, they are also reaping important co-benefits, including local economic benefits, more sustainable communities, and improved quality of life.

Land use planning and urban growth decisions are also areas where successful implementation of the Scoping Plan relies on local government. Local governments have primary authority to plan, zone, approve, and permit how and where land is developed to accommodate population growth and the changing needs of their jurisdictions. Decisions on how land is used will have large impacts on the greenhouse gas emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas sectors.

To provide local governments guidance on how to inventory and report greenhouse gas emissions from government buildings, facilities, vehicles, wastewater and potable water treatment facilities, landfill and composting facilities, and other government operations, ARB recently adopted the Local Government Operations Protocol. ARB encourages local governments to use this protocol to track their progress in achieving reductions from municipal operations. ARB is also developing an additional protocol for community emissions. This protocol will go beyond just municipal operations and include emissions from the community as a whole, including residential and commercial activity. These local protocols will play a key role in ensuring that strategies that are developed and implemented at the local level, like urban forestry and greening projects, water and energy efficiency projects, and others, can be appropriately quantified and credited toward California's efforts to reduce greenhouse gas emissions.

In addition to tracking emissions using these protocols, ARB encourages local governments to adopt a reduction goal for municipal operations emissions and move toward establishing similar goals for community emissions that parallel the State commitment to reduce greenhouse gas emissions by approximately 15 percent from current levels by 2020. To consolidate climate action resources and aid local governments in their emission reduction efforts, the ARB is developing various tools and guidance for use by local governments, including the next generation of best practices, case studies, a calculator to help calculate local greenhouse gas emissions, and other decision support tools.

The recent passage of SB 375 (Steinberg, Chapter 728, Statutes of 2008) creates a process whereby local governments and other stakeholders work together within their region to achieve reduction of greenhouse gas emissions through integrated development patterns, improved transportation planning, and other transportation measures and policies. The implementation of regional transportation-related greenhouse gas emissions targets and SB 375 are discussed in more detail in Section C.

C. Emissions Reduction Measures

The Scoping Plan will build on California's successful history of balancing effective regulations with economic progress. Several types of measures have been recommended. The plan includes a California cap-and-trade program that will be integrated with a broader regional market to maximize cost-effective opportunities to achieve GHG emissions reductions. The plan also includes transformational measures that are designed to help pave the path toward California's clean energy future. For example, the Low Carbon Fuel

Standard (LCFS) is a performance standard with flexible compliance mechanisms that will incent the development of a diverse set of clean, low-carbon transportation fuel options. Similarly, the plan recognizes the importance of local and regional government leadership in ensuring that California's land use and transportation planning processes are designed to be consistent with efforts to achieve a clean energy future and to protect and enhance public health and safety.

The Scoping Plan also contains a number of targeted measures that are designed to overcome existing barriers to action such as lack of information, lack of coordination, or other regulatory and institutional factors. Energy efficiency is a classic example where cost-effective action often is not taken due to lack of complete information, relatively high initial costs, and mismatches between who pays for and who benefits from efficiency investments. These problems often mean that efficiency measures are not taken that would save money in the long term for small businesses, home owners and renters. While California has a long history of success in implementing regulations and programs to encourage energy efficiency, innovative methods to overcome these economic and information barriers are needed to provide the benefits of increased efficiency to more Californians and to meet our greenhouse gas emissions reduction goals.

Several of the recommended measures complement each other. For example, the LCFS will provide clean transportation fuel options. The Pavley performance standards help deploy vehicles that can use many of the low-carbon fuels, including advanced biofuels, electricity and hydrogen. The combined operation of both programs will make it more likely that more efficient, less polluting vehicles will use the cleanest possible fuels. In addition, both of these programs will benefit from ARB's zero-emission vehicle program, which focuses on deployment of plug-in battery-electric and fuel cell vehicles. All of these strategies are expandable beyond 2020, and are needed as vital components to reach the State's 2050 goal.

The cap-and-trade program creates an emissions limit or "cap" on the sectors responsible for the vast majority of California's greenhouse gas emissions and provides capped sources significant flexibility in how they collectively achieve the reductions necessary to meet the cap. The other measures in these capped sectors provide a clear path toward achieving reductions required by the cap, while simultaneously addressing market barriers and creating the low-carbon energy options needed to achieve our long term climate goals. In the design of the cap-and-trade program, ARB will also evaluate possible ways to include features that complement the other measures, such as consideration of allowance set-asides that could be used to help achieve or exceed the aggressive energy efficiency goals included in this Plan.

Both required measures and other cost-effective actions by capped sectors will contribute toward achievement of the cap. For example, increasing energy efficiency will reduce electricity demand, thereby reducing the need for utilities to submit allowances to comply with the cap-and-trade program. In this way, energy efficiency contributes to real reductions toward the cap. Expiration of existing utility long-term contracts with coal plants will reduce GHG emissions when such generation is replaced by renewable generation, coal with carbon sequestration, or natural gas generation, which emits less CO_2 per megawatt-hour.

Additionally, measures and other actions that result in reductions in energy demand 'downstream' of capped sectors will help achieve the cap. For example, the Pavley vehicle standards, building efficiency standards, and land use planning that contributes to reduced transportation fuel demand will all reduce emissions by reducing the demand for upstream energy production. These downstream entities will further benefit from these reductions by avoiding any costs that would be passed through from a cap-and-trade system.

Discrete Early Actions

In September 2007, ARB approved a list of nine Discrete Early Actions to reduce greenhouse gas emissions and is currently in the process of developing regulations and programs based on these measures. Regulations implementing the Discrete Early Action measures must be adopted and in effect by January 1, 2010 (HSC §38560.5 (b)). All the Discrete Early Actions are included in the recommended measures and are shown below in Table 4.

Table 4: Anticipated Board Consideration Dates for Discrete Early Actions

Discrete Early Action	Anticipated Board Consideration
Green Ports – Ship Electrification at Ports	December 2007 – Adopted
Reduction of High GWP Gases in Consumer Products	June 2008 – Adopted
SmartWay – Heavy-Duty Vehicle Greenhouse Gas Emission Reduction (Aerodynamic Efficiency)	December 2008
Reduction of Perfluorocarbons from Semiconductor Manufacturing	February 2009
Improved Landfill Gas Capture	January 2009
Reduction of HFC-134a from Do-It-Yourself Motor Vehicle Servicing	January 2009
SF_6 Reductions from the Non-Electric Sector	January 2009
Tire Inflation Program	March 2009
Low Carbon Fuel Standard	March 2009

The following sections describe the recommended measures in this Scoping Plan. Additional information about these measures is provided in Appendix C.

1. California Cap-and-Trade Program Linked to Western Climate Initiative Partner Jurisdictions

Implement a broad-based California cap-and-trade program to provide a firm limit on emissions. Link the California cap–and-trade program with other Western Climate Initiative Partner programs to create a regional market system to achieve greater environmental and economic benefits for California. Ensure California's program meets all applicable AB 32 requirements for market-based mechanisms.

California is working closely with other states and provinces in the Western Climate Initiative (WCI) to design a regional cap-and-trade program that can deliver reductions of greenhouse gas emissions throughout the region. ARB will develop a cap-and-trade program for California that will link with the programs in the other WCI Partner jurisdictions to create a regional cap-and-trade program. The WCI Partner jurisdictions released the program design document on September 23, 2008 (see Appendix D). ARB will continue to work with the WCI Partner jurisdictions to develop and implement the cap-and-trade program. ARB will also design the California program to meet the requirements of AB 32, including the need to consider any potential localized impacts and ensure that reductions are enforceable by the Board.

Based on the requirements of AB 32, regulations to implement the cap-and-trade program need to be developed by January 1, 2011, with the program beginning in 2012. This rule development schedule will be coordinated with the WCI timeline for developing a regional cap-and-trade program. Preliminary plans for this rulemaking are described later in this section.

A cap-and-trade program sets the total amount of greenhouse gas emissions allowable for facilities under the cap and allows covered sources, including producers and consumers of energy, to determine the least expensive strategies to comply. The emissions allowed under the cap will be denominated in metric tons of CO_2E. The currency will be in the form of allowances which the State will issue based upon the total emissions allowed under the cap during any specific compliance period. Emission allowances can be banked for future use, encouraging early reductions and reducing market volatility. The ability to trade allows facilities to adjust to changing conditions and take advantage of reduction opportunities when those opportunities are less expensive than buying additional emissions allowances.

Provisions could be made to allow a limited use of surplus reductions of greenhouse gas emissions that occur outside of the cap. These additional reductions are known as offsets and are discussed further below. In order to be used to meet a source's compliance obligation, offsets will be subject to stringent criteria and verification procedures to ensure their enforceability and consistency with AB 32 requirements.

Appendix C describes the fundamentals of a cap-and-trade program and program design elements. Appendix D contains the WCI Design Recommendations and related background documents.

California Cap-and-Trade Program

By providing a firm cap on 85 percent of the state's greenhouse gas emissions, the cap-and-trade regulatory program is an essential component of the overall plan to meet the 2020 target and provides a robust mechanism to achieve the additional reductions needed by 2050. To meet the emissions reduction target under AB 32, the limit on emissions allowed under the cap, plus emissions from uncapped sources, must be no greater than the 2020 emissions goal.

By setting a limit on the quantity of greenhouse gases emitted, a well-designed cap-and-trade program will complement other measures for entities within covered sectors. Additionally, starting a cap-and-trade program now will set us on a course to achieve further emissions cuts well beyond 2020 and ensure that California is primed to take advantage of opportunities for linking with other programs, including future federal and international efforts.

The proposed cap-and-trade measure phases in the following sectors:

Starting in the first compliance period (2012):

- In-state electrical generating facilities that emit over 25,000 metric tons CO_2E per year,[22] including imports not covered by a WCI Partner jurisdiction.
- Large industrial facilities that emit over 25,000 metric tons CO_2E per year, including high global warming potential gases.

Starting in the second compliance period (2015):

- Upstream treatment of industrial fuel combustion at facilities with emissions at or below 25,000 metric tons CO_2E per year, and all commercial and residential fuel combustion regulated where the fuel enters into commerce
- Transportation fuel combustion regulated where the fuel enters into commerce.

For some energy-intensive industrial sources such as cement, stringent requirements in California, either through inclusion in a cap-and-trade program or through source-specific regulation, have the potential to create a disadvantage for California facilities relative to out-of-state competitors unless those locations have similar requirements (e.g., through the WCI). If production shifts outside of California in order to operate without being subject to these requirements, emissions could remain unchanged or even increase. This is referred to as "leakage." AB 32 requires ARB to design measures to minimize leakage. Minimizing leakage will be a key consideration when developing the cap-and-trade regulation and the other AB 32 program measures.[23]

[22] Allowances will not be required for combustion emissions from carbon-neutral projects.

[23] The cement industry is an example of a sector that may be susceptible to this type of leakage, and the Draft Scoping Plan included consideration of a measure to institute an intensity standard at concrete batch plants that would consider this type of life-cycle emissions. ARB will evaluate whether this type of intensity standard could be incorporated into the cap-and-trade program or instituted as a complementary measure during the cap-and-trade rulemaking.

As shown in Table 5, the preliminary estimate of the cap on greenhouse gas emissions for sectors covered by the cap-and-trade program is 365 $MMTCO_2E$ in 2020, which covers about 85 percent of California's total greenhouse gas emissions.[24] Greenhouse gas emissions from most of the sectors covered by a cap-and-trade program will also be governed by other measures, including performance standards, efficiency programs, and direct regulations. These other measures will provide real reductions which will contribute reductions toward the cap.

In addition, ARB will work closely with the CPUC, CEC, and The California Independent System Operator to ensure that the cap-and-trade program works within the context of the State's energy policy and enables the reliable provision of electricity.

Table 5: Sector Responsibilities Under Cap-and-Trade Program
($MMTCO_2E$ in 2020)

Sector	Projected 2020 Business-as-Usual Emissions		Preliminary 2020 Emissions Limit under Cap-and-Trade Program
	By Sector	Total	
Transportation	225	512	365
Electricity	139		
Commercial and Residential	47		
Industry	101		

Linkage with the Western Climate Initiative Partner Jurisdictions

The WCI was formed in 2007. Members are California, Arizona, New Mexico, Oregon, Washington, Utah, and Montana, and the Canadian provinces of British Columbia, Manitoba, Ontario, and Quebec. The WCI Partner jurisdictions, including California, have adopted goals to reduce greenhouse gas emissions that, in total, reduce regional emissions to 15 percent below 2005 levels by 2020. This regional goal is approximately equal to California's goal of returning to 1990 levels by 2020. A cap-and-trade program is one element of the effort by the WCI Partner jurisdictions to identify, evaluate, and implement ways to reduce greenhouse gas emissions and achieve related co-benefits.

[24] The actual cap for the program will be established as part of the rulemaking process. The preliminary cap of 365 $MMTCO_2E$ in 2020 assumes that all of California's electricity imports would be covered under a California cap. Because a significant portion of California's imported electricity is from power plants located in other WCI Partner Jurisdictions, emissions from those sources could be included in the cap of the states within which the power plants are located. In establishing the California cap, ARB will need to consider the degree to which emissions from these sources are addressed as part of the WCI regional market.

The WCI Partner jurisdictions released their recommendation for the design of a regional cap-and-trade program in September 2008. This design document and the background paper that accompanied it are presented in Appendix D. These recommendations were developed collaboratively by the WCI Partner jurisdictions, including California, with a goal of achieving regional targets to reduce greenhouse gas emissions equitably and effectively. The WCI Partner jurisdictions' recommendations are generally consistent with the recommendations provided in June 2007 by the California Market Advisory Committee,[25] the recommendations provided to ARB by the California Public Utilities Commission and the California Energy Commission in March 2008,[26] and the proposed opinion released by the two Commissions in September 2008.[27]

Participating in a regional system has several advantages for California. The reduction of greenhouse gas emissions that can be achieved collectively by the WCI Partner jurisdictions are approximately double what can be achieved through a California-only program. The broad scope of a WCI-wide market will provide additional opportunities for reduction of emissions, therefore providing greater market liquidity and more stable carbon prices within the program. The regional system also significantly reduces the potential for leakage, which is a shift in economic and emissions activity out of California that could hurt the state's economy without reducing global greenhouse gas emissions. Harmonizing the approach and timing of California's requirements for reducing greenhouse gas emissions with other states and provinces in the region can encourage retention of local businesses in the state. Further, by creating a cost-effective regional market system, California and the other WCI Partner jurisdictions will continue to demonstrate leadership in preparation for future federal and international climate action.

To achieve the individual WCI Partner jurisdiction goals and the regional goal, each WCI Partner jurisdiction will have an allowance budget based on its goal that declines to 2020. For example, California's allowance budget will be based on the level of emissions needed to achieve the AB 32 target for 2020, as described above. Once California links with the other WCI Partner jurisdictions, allowances could be

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[25] Recommendations of the Market Advisory Committee to the California Air Resources Board. *Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California*. June 30, 2007. p. 19. http://www.climatechange.ca.gov/publications/market_advisory_committee/2007-06-29_MAC_FINAL_REPORT.PDF (accessed October 12, 2008) Cal/EPA The Market Advisory Committee (MAC) consisted of a consortium of economists, policy makers, academics, government representatives, and environmental advocates who came together through the auspices of CalEPA, pursuant to Executive Order S-20-06 from Governor Schwarzenegger.

[26] Joint Agency Decision of the CEC and the CPUC. *Final Adopted Interim Decision on Basic Greenhouse Gas Regulatory Framework for Electricity and Natural Gas Sectors*, March 13, 2008. Document number CEC-100-2008-002-F. http://www.energy.ca.gov/2008publications/CEC-100-2008-002/CEC-100-2008-002-F.PDF (accessed October 12, 2008)

[27] Joint Agency proposed final opinion of the CEC and the CPUC. *Proposed Final Opinion on Greenhouse Gas Regulatory Strategies*. Published September 12, 2008 and to be considered for adoption on October 16, 2008 by the CEC and the CPUC. Document Number CEC-100-2008-007-D http://www.energy.ca.gov/ghg_emissions/index.html (accessed October 12, 2008)

traded across state and provincial boundaries. As a result of trading, emissions in a state may vary from its allowance budget, although total regional emissions will not exceed the regional cap.

The overall number of allowances issued in a given year by the WCI Partner jurisdictions will set a limit on emissions from sectors covered by the program for the region. Details of distribution of allowances will be established by each partner within the general guidelines set forth in the WCI program design framework. The WCI Partner jurisdictions have agreed to consider standardizing allowance distribution across specific sectors if necessary to address competitiveness issues. In addition, the WCI Partner jurisdictions have agreed to phase in regionally coordinated auctions of allowances, with a minimum percentage of allowances auctioned in each period starting with 10 percent in the first compliance period and increasing to 25 percent in 2020. WCI partners aspire to reach higher auction percentages over time, possibly to 100 percent. Under the program design, each WCI Partner jurisdiction, including California, can auction a greater portion of its allowance budget in any compliance period. The distribution of California's allowances will be determined during the cap-and-trade rulemaking process, as discussed below.

The WCI Partner jurisdictions are also proposing the use of an allowance reserve price for the first 5 percent of the auctioned allowances in the regional cap. A reserve price will help to ensure that the cap is set at a level that will motivate real emissions reductions and may provide an opportunity for the regional cap-and-trade program to provide reductions that exceed the regional target.

A regional coordinated cap-and-trade program with strong reporting and enforcement rules will provide a high degree of certainty that emissions will not exceed targeted levels and that leakage will not occur.

Federal Action

A cap-and-trade program is expected to be a significant element in any future federal action taken to reduce greenhouse gas emissions. ARB's efforts to design a broad cap-and-trade system that works in concert with sector- or source-related measures and meets the requirements of AB 32 can serve as a model for a federal program. An effective, enforceable regional cap-and-trade program can promote the type of federal legislation needed to meet the pressing challenge of climate change. In the event that California businesses, organizations, or individuals hold regional allowances when a federal system is implemented, California will work to ensure that those allowances continue to have value, either in a continuing regional program or within the federal program.

Cap-and-Trade Rulemaking

To implement the cap-and-trade program, ARB will embark on regulatory development that includes extensive and broad-based public participation. Major program design elements will include setting an emissions cap in conjunction with the

WCI Partner jurisdictions, determining the method of distributing both allowances and revenues raised through auctions, and establishing the rules for the use of offsets. ARB will continue to work with all affected stakeholders, State and local agencies, and our WCI partners to create a robust regional market system.

After adoption of the Scoping Plan, ARB will establish a formal structure to elicit ongoing participation in the rulemaking process from a wide range of affected stakeholders. While the process will be open to involvement by all interested parties, ARB anticipates creation of a series of focused working groups that include participation by representatives of the regulated community, environmental and community advocates and other public interest groups, prominent academics with expertise in cap-and-trade issues and new technology development, local air pollution control districts, stakeholders in the WCI, and other State agencies with existing authority for regulating capped sectors.

This process will integrate economic and administrative design considerations and include consideration of environmental and public health issues. ARB will convene a series of technical workshops to examine mechanisms to address the concerns related to the cap-and-trade program raised by the Environmental Justice Advisory Committee and other stakeholders. The first workshop will explore cap-and-trade program design options that could provide incentives to maximize additional environmental and economic benefits, and to analyze the proposed program to prevent increases in emissions of toxic air contaminants or criteria pollutants through the design and architecture of the program itself. Similar technical workshops will focus on issues related to offsets and the WCI proposal.

Allowances and Revenues

Emission allowances represent a significant economic value whether they are freely allocated or sold through auction. Section E includes a preliminary discussion of some of the options that have been suggested for use of allowance value or revenues. ARB will evaluate the possible uses of allowances or revenues as part of the rulemaking process. One approach would be to dedicate a portion of the allowances for such purposes as rewarding early actions to reduce emissions, providing incentives for local governments and others to promote energy efficiency, better land use planning, and other reduction strategies, and targeting projects to reduce emissions in low-income or disadvantaged communities. This type of dedicated use of allowances is typically referred to as an allowance 'set-aside.'

The California Public Utilities Commission and the California Energy Commission addressed the question of allocation and auction of allowances in their joint proceeding on implementation of AB 32 for the Electricity and Natural Gas sectors. They have recently released a proposed opinion that recommends to ARB a transition

to 100 percent auction for the Electricity sector by 2016.[28] The CPUC and CEC included in their draft opinion the recommendation that all auction revenues be used for purposes related to AB 32, and all revenue from allowances allocated to the Electricity sector and received by retail providers would be used for the benefit of the Electricity sector to support investments in renewable energy, efficiency, new energy technology, infrastructure, customer bill relief, and other similar programs.

The Market Advisory Committee also recommended the eventual transition to full auction within the cap-and-trade program, noting that a system in which California ultimately auctions all of its emission allowances is consistent with fundamental objectives of cost-effectiveness, fairness and simplicity.[29] ARB agrees that the transition to a 100 percent auction, with auction revenue going to further the policy objectives of California's climate change program, is a worthwhile goal. ARB expects that California will auction significantly more than the WCI minimum levels and will transition to 100 percent auction. However a broad set of factors must be considered in evaluating the potential timing of a transition to a full auction including competiveness, potential for emissions leakage, the effect on regulated vs. unregulated industrial sectors, the overall impact on consumers, and the strategic use of auction revenues.

Allowance allocation and revenue use decisions can greatly affect the equity of a cap-and-trade system. Addressing both these issues will be a major part of the rulemaking process. ARB will seek input from a broad range of experts in an open public process regarding the options for allocation and revenue use under consideration by ARB and the WCI Partner jurisdictions. This process will evaluate various mechanisms ARB is considering for allowance distribution and potential uses of allowance value, including the recommendations offered by CPUC and CEC. Issues to be considered will include the appropriate timing and structure of a transition to full auction of allowances, the potential need to harmonize the allocation process regionally for certain sectors subject to inter-state competition, and equity across the various sectors here in California.

Offsets

Individual projects can be developed to achieve the reduction of emissions from activities not otherwise regulated, covered under an emissions cap, or resulting from government incentives. These projects can generate "offsets," i.e., verifiable reductions of emissions whose ownership can be transferred to others. The cap-and-trade rulemaking will establish appropriate rules for use of offsets. As required by

[28] Op. Cit. The proposed opinion has not yet been voted on by either the CPUC or the CEC. The Commissions are expected to vote on this proposed opinion before the December Board meeting when the Proposed Scoping Plan will be considered for approval.

[29] Recommendations of the Market Advisory Committee to the California Air Resources Board. *Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California*. June 30, 2007. p. 55. http://www.climatechange.ca.gov/publications/market_advisory_committee/2007-06-29_MAC_FINAL_REPORT.PDF (accessed October 12, 2008)

AB 32, any reduction of greenhouse gas emissions used for compliance purposes must be real, permanent, quantifiable, verifiable, enforceable, and additional (HSC §38562(d)(1) and (2)). Offsets used to meet regulatory requirements must be quantified according to Board-adopted methodologies, and ARB must adopt a regulation to verify and enforce the reductions (HSC §38571). The criteria developed will ensure that the reductions are quantified accurately and are not double-counted within the system.

Offsets can provide regulated entities a source of low-cost emissions reductions. Reductions from compliance offset projects must be quantified using rigorous measurement and enforcement protocols that provide a basis to determine whether the reductions are also additional, i.e., beyond what would have happened in the absence of the offset project. Establishing that reductions are additional is one of the major challenges in establishing the validity of particular offset projects. Once a project can quantify emissions using an approved methodology, the reductions of emissions must be verified to ensure that reductions actually occurred.

While some offsets provide benefits, allowing unlimited offsets would reduce the amount of reductions of greenhouse gas emissions occurring within the sectors covered by the cap-and-trade program. This could reduce the local economic, environmental and public health co-benefits and delay the transition to low-carbon energy systems within the capped sectors that will be necessary to meet our long term climate goals. The limit on the use of offsets and allowances from other systems within the WCI Partner jurisdiction program design assures that a majority of the emissions reductions required from 2012 to 2020 occur at entities and facilities covered by the cap and trade program. Consequently, the use of offsets and allowances from other systems are limited to no more than 49 percent of the required reduction of emissions. This quantitative limit will help provide balance between the need to achieve meaningful emissions reductions from capped sources with the need to provide sources within capped sectors the opportunity for low-cost reduction opportunities that offsets can provide. The WCI offset program may incorporate flexibility to use offsets and non-WCI allowances across the three compliance periods, which each WCI Partner jurisdiction could use at its discretion. ARB will apply the limit on offsets that is within its jurisdiction, such that the allowable offsets in each compliance period is less than half of the emissions reductions expected from capped sectors in that compliance period. Each WCI Partner jurisdiction may choose to adopt a more stringent limit on the use of offsets and non-WCI allowances.

Offsets can also encourage the spread of clean, low carbon technologies outside California. High quality offset projects located outside the state can help lower the compliance costs for regulated entities in California, while reducing greenhouse gas emissions in areas that would otherwise lack the resources needed to do so. International projects may also have significant environmental, economic and social benefits. Projects in the Mexican border region may be of particular interest, considering the opportunity to realize considerable co-benefits on both sides of the border. The Governor has recently signed a Memorandum of Understanding with the

six Mexican border states that calls for cooperation on the development of project protocols for Mexican greenhouse gas emissions reduction projects.[30] Additionally, defining project types related to imported commodities (such as cement) would enable California to provide incentives to reduce emissions associated with products that are imported into the state for our consumption.

California is committed to working at the international level to reduce greenhouse gas emissions globally and finding ways to support the adoption of low-carbon technologies and sustainable development in the developing world. ARB will work with WCI Partner jurisdictions and within the rulemaking process to establish an offsets program without geographic restrictions that includes sufficiently stringent criteria for creating offset credits to ensure the overall environmental integrity of the program.

One concept being evaluated for accepting offsets from the developing world is to limit offsets to those jurisdictions that demonstrate performance in reducing emissions and/or achieving greenhouse gas intensity targets in certain carbon intensive sectors (e.g., cement), or in reducing emissions or enhancing sequestration through eligible forest carbon activities in accordance with appropriate national or sub-national accounting frameworks. This could be achieved through an agreement to work jointly to develop minimum performance standards or sectoral benchmarks, backed by appropriate monitoring and accounting frameworks. Such agreements would encourage early action in developing countries toward binding commitments, and could also reduce concerns about competitiveness and risks associated with carbon leakage.

2. California Light-Duty Vehicle Greenhouse Gas Standards

Implement adopted Pavley standards and planned second phase of the program. Align zero-emission vehicle, alternative and renewable fuel and vehicle technology programs with long-term climate change goals.

Passenger vehicles are responsible for almost 30 percent of California's greenhouse gas emissions. To address these emissions, ARB is proposing a comprehensive three-prong strategy – reducing greenhouse gas emissions from vehicles, reducing the carbon content of the fuel these vehicles burn, and reducing the miles these vehicles travel. Transportation fuels and regional transportation-related greenhouse gas targets are discussed later in the recommendations.

There are a number of efforts intended to reduce greenhouse gas emissions from California's passenger vehicles, including the Pavley greenhouse gas vehicle

[30] Memorandum of Understanding on Environmental Cooperation between the California Environmental Protection Agency, the California Department of Food and Agriculture and the California Resources Agency of the State of California, United States of America and the Ministry of Environment and Natural Resources of the United Mexican States. February 13, 2008. http://gov.ca.gov/pdf/press/021308_MOU_English.pdf (accessed October 12, 2008)

standards to achieve near-term emission reductions, the zero-emission vehicle (ZEV) program to transform the future vehicle fleet, and the Alternative and Renewable Fuel and Vehicle Technology Program created by AB 118 (Núñez, Chapter 750, Statutes of 2007).

Pavley Greenhouse Gas Vehicle Standards

AB 1493 (Pavley, Chapter 200, Statutes of 2002) directed ARB to adopt vehicle standards that lowered greenhouse gas emissions to the maximum extent technologically feasible, beginning with the 2009 model year. ARB adopted regulations in 2004 and applied to the U.S. Environmental Protection Agency (U.S. EPA) for a waiver under the federal Clean Air Act to implement the regulation. The Pavley regulations incorporate both performance standards and market-based compliance mechanisms. To obtain additional reductions from the light duty fleet, ARB plans to adopt a second, more stringent, phase of the Pavley regulations. Table 6 summarizes the estimated reduction of emissions for the Pavley regulations. In addition to delivering greenhouse gas emissions reductions, the standards will save money for Californians who purchase vehicles that comply with the Pavley standards – an estimated average of $30 each month in avoided fuel costs.

To date, 13 other states have adopted California's existing greenhouse gas standards for vehicles. Under federal law, California is the only state allowed to adopt its own vehicle standards (though other states are permitted to adopt California's more rigorous standards), but California cannot implement the regulations until U.S. EPA grants an administrative waiver. In December 2007, U.S. EPA denied California's waiver request to implement the Pavley regulations. California and others are challenging that denial in Federal court. The regulations have also been challenged by the automakers in federal courts, although to date, those challenges have been unsuccessful.

ARB is evaluating the use of feebates as a measure to achieve additional reductions from the mobile source sector, either as a backstop to the Pavley regulation if the regulation cannot be implemented, or as a supplement to Pavley if the waiver is approved and the regulation takes effect. AB 32 specifically states that if the Pavley regulations do not remain in effect, ARB shall implement alternative regulations to control mobile sources to achieve equivalent or greater reductions of greenhouse gas emissions (HSC §38590). ARB is currently evaluating the use of a feebate program as the mechanism to secure these reductions. A feebate regulation would combine a rebate program for low-emitting vehicles with a fee program for high-emitting vehicles. This program would be designed in a way to generate equivalent or greater cumulative reductions of greenhouse gas emissions compared to what would have been achieved under the Pavley regulations. ARB would also evaluate the potential to expand the program to include additional vehicle classes not currently included in the Pavley program for further greenhouse gas benefits.

If the U.S. EPA grants California's request for a waiver to proceed with implementation of the Pavley regulations, we will analyze the potential for pursuing a

feebate program that could complement the Pavley regulations and achieve additional reductions of greenhouse gas emissions.

Zero-Emission Vehicle Program

The Zero Emission Vehicle (ZEV) program will play an important role in helping California meet its 2020 and 2050 greenhouse gas emissions reduction requirements. Through 2012, the program requires placement of hundreds of ZEVs (including hydrogen fuel cell and battery electric vehicles) and thousands of near-zero emission vehicles (plug-in hybrids, conventional hybrids, compressed natural gas vehicles). In the mid-term (2012-2015), the program will require placement of increasing numbers of ZEVs and near-zero emission vehicles in California. In 2009, the Board will consider a proposal that is currently being developed to ensure that the ZEV program is optimally designed to help the State meet its 2020 target and put us on the path to meeting our 2050 target of an 80 percent reduction in greenhouse gas emissions.

It is important to note that while the use of both battery-powered electric vehicles and plug-in hybrids (which can be plugged in to recharge batteries) is not expected to increase electricity demand in the near term, over the longer term these technologies could result in meaningful new electricity demand. However, the expected increased electricity demand is likely to be met by off peak vehicle battery charging (i.e., overnight) to provide a means of load leveling and other possible benefits.[31]

Air Quality Improvement Program/Alternative and Renewable Fuel and Vehicle Technology Program

Under AB 118 (Núñez, Chapter 750, Statutes of 2007), ARB is administering the Air Quality Improvement Program, which provides approximately $50 million per year for grants to fund clean vehicle/equipment projects and research on the air quality impacts of alternative fuels and advanced technology vehicles.

AB 118 also created the Alternative and Renewable Fuel and Vehicle Technology Program and authorized CEC to spend up to $120 million per year for over seven years (from 2008-2015) to develop, demonstrate, and deploy innovative technologies to transform California's fuel and vehicle types. This program creates the opportunities for investment in technologies and fuels that will help meet the Low Carbon Fuel Standard, the AB 1007 (Pavley, Chapter 371, Statutes of 2005) goal of increasing alternative fuels, the AB 32 goal of reducing greenhouse gas emissions to 1990 levels by 2020, and the State's overall goal of reducing greenhouse gas emissions 80 percent below 1990 levels by 2050. CEC and ARB are coordinating closely in the implementation of AB 118. In the long-term, programs to reduce greenhouse gas emissions from cars would reduce highway funds because less fuel would be sold, reducing tax revenue. In coordination with other State agencies, ARB

[31] There is also a potential for battery-electric and hybrid vehicles (both plug-in and traditional hybrid-electric) to be used in the future to provide electricity back into the electricity grid during times of especially high demand (peak periods).

will continue to evaluate the potential impacts of these shifts and identify potential solutions.

Table 6: California Light-Duty Vehicle Greenhouse Gas Standards Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
T-1	Pavley I and II – Light-Duty Vehicle Greenhouse Gas Standards	31.7
	Total	**31.7**

3. Energy Efficiency

Maximize energy efficiency building and appliance standards, and pursue additional efficiency efforts including new technologies, and new policy and implementation mechanisms. Pursue comparable investment in energy efficiency from all retail providers of electricity in California (including both investor-owned and publicly-owned utilities).

Energy-efficiency measures for both electricity and natural gas can reduce greenhouse gas emissions significantly. In 2003, the CPUC and CEC adopted an Energy Action Plan that prioritized resources for meeting California's future energy needs, with energy efficiency being first in the "loading order," or highest priority. Since then, this policy goal has been codified into statute through legislation that requires electric utilities to meet their resource needs first with energy efficiency.[32]

This measure would set new targets for statewide annual energy demand reductions of 32,000 gigawatt hours and 800 million therms from business as usual[33] – enough to power more than 5 million homes, or replace the need to build about ten new large power plants (500 megawatts each). These targets represent a higher goal than existing efficiency targets established by CPUC for the investor-owned utilities due to the inclusion of innovative strategies above traditional utility programs. Achieving the State's energy efficiency targets will require coordinated efforts from the State, the federal government, energy companies and customers. ARB will work with CEC and CPUC to facilitate these partnerships. A number of these measures also have the potential to deliver significant economic benefits to California consumers, including low-income households and small businesses. California's energy efficiency programs for buildings and appliances have generated more than $50 billion in

[32] SB 1037 (Kehoe, Chapter 366, Statutes of 2005) and AB 2021 (Levine, Chapter 734, Statutes of 2006) directed electricity corporations subject to CPUC's authority and publicly-owned electricity utilities to first meet their unmet resource needs through all available energy efficiency and demand response resources that are cost effective, reliable and feasible.

[33] The savings targeted here are additional to savings currently assumed to be incorporated in CEC's 2007 demand forecasts. However, CEC has initiated a public process to better determine the quantity of energy savings from standards, utility programs, and market effects that are embedded in the baseline demand forecast.

savings over the past three decades. Tables 7 and 8 summarize the reduction of greenhouse gas emissions.

Efficiency

Achieving the energy efficiency target will require redoubled efforts to target industrial, agricultural, commercial, and residential end-use sectors, comprised of both innovative new initiatives that have been embraced by CEC's energy policy reports and CPUC's long-term strategic plan, and improvements to California's traditional approaches of improved building standards and utility programs.

High-efficiency distributed generation applications like fuel cell technologies can also play an important role in helping the State meet its requirements for reduction of greenhouse gas emissions. Key energy efficiency strategies, grouped by type, include:

Cross-cutting Strategy for Buildings

- "Zero Net Energy" buildings[34]

Codes and Standards Strategies

- More stringent building codes and appliance efficiency standards
- Broader standards for new types of appliances and for water efficiency
- Improved compliance and enforcement of existing standards
- Voluntary efficiency and green building targets beyond mandatory codes

Strategies for Existing Buildings

- Voluntary and mandatory whole-building retrofits for existing buildings
- Innovative financing to overcome first-cost and split incentives for energy efficiency, on-site, renewables, and high efficiency distributed generation

Existing and Improved Utility Programs

- More aggressive utility programs to achieve long-term savings

Other Needed Strategies

- Water system and water use efficiency and conservation measures
- Local government programs that lead by example and tap into local authority over planning, development, and code compliance
- Additional industrial and agricultural efficiency initiatives
- Providing real time energy information technologies to help consumers conserve and optimize energy performance

With the support of key State agencies, utilities, local governments and others, the CPUC has recently adopted the *California Long Term Energy Efficiency Strategic*

[34] Zero net energy refers to building energy use over the course of a typical year. When the building is producing more electricity than it needs, it exports its surplus to the grid. When the building requires more electricity than is being produced on-site, it draws from the grid. Generally, when constructing a ZNE building, energy efficiency measures can result in up to 70% savings relative to existing building practices, which then allows for renewables to meet the remaining load.

Plan.[35] Released September 2008, this Plan sets forth a set of strategies toward maximizing the achievement of cost-effective energy efficiency in California's Electricity and Natural Gas sectors between 2009 and 2020, and beyond. Its recommendations are the result of a year-long collaboration by energy experts, utilities, businesses, consumer groups, and governmental organizations in California, throughout the west, nationally and internationally.

For many of the above goals and others, the Strategic Plan discusses practical implementation strategies, detailing necessary partnerships among the state, its utilities, the private sector, and other market players and timelines for near-term, mid-term and long-term success. While the Strategic Plan is the most current and innovative summary of energy efficiency strategies needed to meet State goals, additional planning and new strategies will likely be needed, both to achieve the 2020 emissions reduction goals and to set the State on a trajectory toward 2050.

Other innovative approaches could also be used to motivate private investment in efficiency improvements. One example that will be evaluated during the development of the cap-and-trade program is the creation of a mechanism to make allowances available within the program to provide incentives for local governments, third party providers, or others to pursue projects to reduce greenhouse gas emissions, including the bundling of energy efficiency improvements for small businesses or in targeted communities.

Solar Water Heating

Solar water heating systems offer a potential for natural gas savings in California. A solar water heating system offsets the use of natural gas by using the sun to heat water, typically reducing the need for conventional water heating by about two-thirds. Successful implementation of the zero net energy target for new buildings will require significant growth in California's solar water heating system manufacturing and installation industry. The State has initiated a program to move toward a self sustaining solar water heater industry. The Solar Hot Water and Efficiency Act of 2007 (SHWEA) authorized a ten year, $250-million incentive program for solar water heaters with a goal of promoting the installation of 200,000 systems in California by 2017.[36]

Combined Heat and Power

Combined heat and power (CHP), also referred to as cogeneration, produces electricity and useful thermal energy in an integrated system. The widespread development of efficient CHP systems would help displace the need to develop new, or expand existing, power plants. This measure sets a target of an additional

[35] California Public Utilities Commission. *California Long Term Energy Efficiency Strategic Plan*. September 2008. http://www.californiaenergyefficiency.com/docs/EEStrategicPlan.pdf (accessed October 12, 2008).

[36] Established under Assembly Bill 1470 (Huffman, Chapter 536, Statues of 2007).

4,000 MW of installed CHP capacity by 2020, enough to displace approximately 30,000 GWh of demand from other power generation sources.[37]

California has supported CHP for many years, but market and other barriers continue to keep CHP from reaching its full market potential. Increasing the deployment of efficient CHP will require a multi-pronged approach that includes addressing significant barriers and instituting incentives or mandates where appropriate. These approaches could include such options as utility-provided incentive payments, the creation of a CHP portfolio standard, transmission and distribution support payments, or the use of feed-in tariffs.

Table 7: Energy Efficiency Recommendation - Electricity
($MMTCO_2E$ in 2020)

Measure No.	Measure Description	Reductions
E-1	Energy Efficiency (32,000 GWh of Reduced Demand) • Increased Utility Energy Efficiency Programs • More Stringent Building & Appliance Standards • Additional Efficiency and Conservation Programs	15.2
E-2	Increase Combined Heat and Power Use by 30,000 GWh	6.7
	Total	**21.9**

Table 8: Energy Efficiency Recommendation - Commercial and Residential
($MMTCO_2E$ in 2020)

Measure No.	Measure Description	Reductions
CR-1	Energy Efficiency (800 Million Therms Reduced Consumption) • Utility Energy Efficiency Programs • Building and Appliance Standards • Additional Efficiency and Conservation Programs	4.3
CR-2	Solar Water Heating (AB 1470 goal)	0.1
	Total	**4.4**

4. Renewables Portfolio Standard

Achieve 33 percent renewable energy mix statewide.

CEC estimates that about 12 percent of California's retail electric load is currently met with renewable resources. Renewable energy includes (but is not limited to) wind, solar, geothermal, small hydroelectric, biomass, anaerobic digestion, and landfill gas. California's current Renewables Portfolio Standard (RPS) is intended to

[37] Accounting for avoided transmission line losses of seven percent, this amount of CHP would actually displace 32,000 GWh from the grid.

increase that share to 20 percent by 2010. Increased use of renewables will decrease California's reliance on fossil fuels, thus reducing emissions of greenhouse gases from the Electricity sector. Based on Governor Schwarzenegger's call for a statewide 33 percent RPS, the Plan anticipates that California will have 33 percent of its electricity provided by renewable resources by 2020, and includes the reduction of greenhouse gas emissions based on this level.

Senate Bill 107 (Simitian, Chapter 464, Statutes of 2006) obligates the investor-owned utilities (IOUs) to increase the share of renewables in their electricity portfolios to 20 percent by 2010. Meanwhile, the publicly-owned utilities (POUs) are encouraged but not required to meet the same RPS. The governing boards of the state's three largest POUs, the Los Angeles Department of Water and Power (LADWP), the Sacramento Municipal Utility District (SMUD), and the Imperial Irrigation District (IID), have adopted policies to achieve 20 percent renewables by 2010 or 2011. LADWP and IID have established targets of 35 and 30 percent, respectively, by 2020.

In 2005, CEC and CPUC committed in the Energy Action Plan II to "evaluate and develop implementation paths for achieving renewable resource goals beyond 2010, including 33 percent renewables by 2020, in light of cost-benefit and risk analysis, for all load serving entities." The proposed opinion in the CPUC/CEC joint proceeding lends strong support for obtaining 33 percent of California's electricity from renewables, and states the two Commissions' belief that this target is achievable if the State commits to significant investments in transmission infrastructure and key program augmentation. As with the energy efficiency target, achieving the 33 percent goal will require broad-based participation from many parties and the removal of barriers. CEC, CPUC, California Independent System Operator (CAISO), and ARB are working with California utilities and other stakeholders to formally establish and meet this goal.

A key prerequisite to reaching a target of 33 percent renewables will be to provide sufficient electric transmission lines to renewable resource zones and system changes to allow integration of large quantities of intermittent wind and solar generation. The Renewable Energy Transmission Initiative (RETI) is a broad collaborative of State agencies, utilities, the environmental community, and renewable generation developers that are working cooperatively to identify and prioritize renewable generation zones and associated transmission projects. Although biomass, geothermal, and small-scale hydroelectric generation can provide steady baseload power, other renewable generation is intermittent (wind) or varies over time (solar). Therefore, integration of intermittent generation into the electricity system will require grid improvements so that fluctuations in power availability can be accommodated. Improved communications technology, automated demand response, electric sub-station improvements and other modern technologies must be implemented both to facilitate intermittent renewables, and to improve grid reliability.

Another key action that may help to achieve the renewable energy goals is to reduce the complexity and cost faced by small renewable developers in contracting with utilities to supply renewable generation. This is particularly important for projects offering below 20 megawatts of generation capacity. One such option may be a feed-in tariff for all RPS-eligible renewable energy facilities up to 20 megawatts in size. This mechanism was recommended in CEC's 2007 Integrated Energy Policy Report. Such a tariff, set at an appropriate level, could benefit small-scale facilities by allowing them to be brought into the electricity grid more rapidly.

For the purposes of calculating the reduction of greenhouse gas emissions in this Scoping Plan, ARB is counting emissions avoided by increasing the percentage of renewables in California's electricity mix from the current level of 12 percent to the 33 percent goal, as shown in Table 9.

Table 9: Renewables Portfolio Standard Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
E-3	Achieve a 33% renewables mix by 2020	21.3
	Total	**21.3**

5. Low Carbon Fuel Standard

Develop and adopt the Low Carbon Fuel Standard.

Because transportation is the largest single source of greenhouse gas emissions in California, the State is taking an integrated approach to reducing emissions from this sector. Beyond including vehicle efficiency improvements and lowering vehicle miles traveled, the State is proposing to reduce the carbon intensity of transportation fuels consumed in California.

To reduce the carbon intensity of transportation fuels, ARB is developing a Low Carbon Fuel Standard (LCFS), which would reduce the carbon intensity of California's transportation fuels by at least ten percent by 2020 as called for by Governor Schwarzenegger in Executive Order S-01-07.

LCFS will incorporate compliance mechanisms that provide flexibility to fuel providers in how they meet the requirements to reduce greenhouse gas emissions. The LCFS will examine the full fuel cycle impacts of transportation fuels and ARB will work to design the regulation in a way that most effectively addresses the issues raised by the Environmental Justice Advisory Committee and other stakeholders. ARB identified the LCFS as a Discrete Early Action item, and is developing a regulation for Board consideration in March 2009. A 10 percent reduction in the intensity of transportation fuels is expected to equate to a reduction of 16.5 MMTCO$_2$E in 2020. However, in order to account for possible overlap of

benefits between LCFS and the Pavley greenhouse gas standards, ARB has discounted the contribution of LCFS to 15 $MMTCO_2E$.

Table 10: Low Carbon Fuel Standard Recommendation
($MMTCO_2E$ in 2020)

Measure No.	Measure Description	Reductions
T-2	Low Carbon Fuel Standard (Discrete Early Action)	15
	Total	**15**

6. Regional Transportation-Related Greenhouse Gas Targets

Develop regional greenhouse gas emissions reduction targets for passenger vehicles.

Establishment of Regional Targets

On September 30, 2008, Governor Arnold Schwarzenegger signed Senate Bill 375 (Steinberg) which establishes mechanisms for the development of regional targets for reducing passenger vehicle greenhouse gas emissions. Through the SB 375 process, regions will work to integrate development patterns and the transportation network in a way that achieves the reduction of greenhouse gas emissions while meeting housing needs and other regional planning objectives. This new law reflects the importance of achieving significant additional reductions of greenhouse gas emissions from changed land use patterns and improved transportation to help achieve the goals of AB 32.

SB 375 requires ARB to develop, in consultation with metropolitan planning organizations (MPOs), passenger vehicle greenhouse gas emissions reduction targets for 2020 and 2035 by September 30, 2010. It sets forth a collaborative process to establish these targets, including the appointment by ARB of a Regional Targets Advisory Committee to recommend factors to be considered and methodologies for setting greenhouse gas emissions reduction targets. SB 375 also provides incentives – relief from certain California Environmental Quality Act (CEQA) requirements for development projects that are consistent with regional plans that achieve the targets.

Reaching the Targets

Transportation planning is done on a regional level in major urban areas, through the Metropolitan Planning Organizations. These MPOs are required by the federal government to prepare regional transportation plans (RTPs) in order to receive federal transportation dollars. These plans must reflect the land uses called out in city and county general plans. Regional planning efforts provide an opportunity for community residents to help select future growth scenarios that lead to more sustainable and energy efficient communities. Such plans should be developed through an extensive public process to provide for local accountability.

SB 375 requires MPOs to prepare a sustainable communities strategy to reach the regional target provided by ARB. MPOs would use the sustainable communities strategy for the land use pattern underlying the region's transportation plan. If the strategy does not meet the target, the MPO must document the impediments and show how the target could be met with an alternative planning strategy. The CEQA relief would be provided to those projects that are consistent with either the sustainable communities strategy or alternative planning strategy, whichever meets the target.

Many regions in California have conducted comprehensive scenario planning, called Blueprint planning, that engages a broad set of stakeholders at the local level on the impacts of land use and transportation choices. The State has allocated resources to initiate or augment existing Blueprint efforts of MPOs. These efforts focus on fostering efficient land use patterns that not only reduce vehicle travel but also accommodate an adequate supply of housing, reduce impacts on valuable habitat and productive farmland, increase resource use efficiency, and promote a prosperous regional economy. Blueprint planning can play an important role in the SB 375 process by helping inform target-setting efforts and building strong sustainable communities strategies.

Local governments will play a significant role in the regional planning process to reach passenger vehicle greenhouse gas emissions reduction targets. Local governments have the ability to directly influence both the siting and design of new residential and commercial developments in a way that reduces greenhouse gases associated with vehicle travel, as well as energy, water, and waste. A partnership of local and regional agencies is needed to create a sustainable vision for the future that accommodates population growth in a carbon efficient way while meeting housing needs and other planning goals. Integration of the sustainable communities strategies or alternative planning strategies with local general plans will be key to the achievement of these goals. State, regional, and local agencies must work together to prioritize and create the supporting policies, programs, incentives, guidance, and funding to assist local actions to help ensure regional targets are met.

Enhanced public transit service combined with incentives for land use development that provides a better market for public transit will play an important role in helping to reach regional targets.

SB 375 maintains regions' flexibility in the development of sustainable communities strategies. There are many different ways regions can plan and work toward reducing the growth in vehicle travel. Increasing low-carbon travel choices (public transit, carpooling, walking and biking) combined with land use patterns and infrastructure that support these low-carbon modes of travel, can decrease average vehicle trip lengths by bringing more people closer to more destinations. The need for integrated strategies is supported by the current transportation and land use modeling literature.

Supporting measures that should be considered in both the regional target-setting and sustainable communities strategy processes include the following:

- Congestion pricing strategies can provide a method of efficiently managing traffic demand while raising funds for needed transit, biking and pedestrian infrastructure investment. Regional and local agencies, however, do not have the authority to pursue these strategies on their own, as federal approval and State authorization must be provided for regional implementation of most pricing measures.

- Indirect source rules for new development have already been implemented by some local air districts and proposed by others for purposes of criteria pollution reduction. Regions should evaluate the need for measures that would ensure the mitigation of high carbon footprint development outside of the sustainable communities strategies or alternative planning strategies that meet the targets established under SB 375.

- Programs to reduce vehicle trips while preserving personal mobility, such as employee transit incentives, telework programs, car sharing, parking policies, public education programs and other strategies that enhance and complement land use and transit strategies can be implemented and coordinated by regional and local agencies and stakeholder groups.

Another way to encourage greenhouse gas reductions from vehicle travel is through pay as you drive insurance (PAYD), a structure in which drivers realize a direct financial benefit from driving less. The California Insurance Commissioner recently announced support for PAYD and has proposed regulations to permit PAYD on a voluntary basis.

Separate emissions reduction estimates for these strategies are not quantified here. As regional targets are developed in the SB 375 process, ARB will work with regions to quantify the benefits in the context of the targets.

Estimating the Benefits of Regional Targets

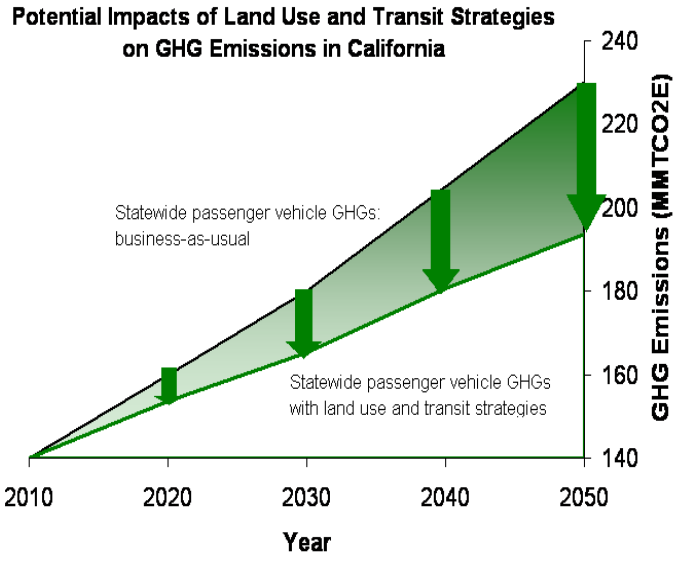
The ARB estimate of the statewide benefit of regional transportation-related greenhouse gas emissions reduction targets is based on analysis of research results quantifying the effects of land use and transportation strategies. The emissions reduction number in Table 11 is not the statewide metric for regional targets that must be developed as SB 375 is implemented. The emissions target will ultimately be determined during the SB 375 process.

The possible impacts of land use and transportation policies have been well documented. Most recently, a 2008 U.C. Berkeley study[38] reviewed over 20

[38]Rodier, Caroline. U.C. Berkeley, Transportation Sustainability Research Center, "A Review of the International Modeling Literature: Transit, Land Use, and Auto Pricing Strategies to Reduce Vehicle Miles Traveled and Greenhouse Gas Emissions," August 2008. http://www.arb.ca.gov/planning/tsaq/docs/rodier_8-1-08_trb_paper.pdf (accessed October 12, 2008)

modeling studies from California (including the State's four largest MPOs), other states and Europe. The study found a range of 0.4 to 7.7 percent reduction in vehicle miles traveled (VMT) resulting from a combination of land use and enhanced transit policies compared to a business-as-usual case over a 10-year horizon, with benefits doubling by 2030, as shown in Figure 4. With the inclusion of additional measures such as pricing policies, the reduction of greenhouse gas emissions can be greater. These strategies will be considered during the target-setting process. Sophisticated land use and transportation models can best assess these effects. As part of the development of regional targets, technical tools will need to be refined to ensure sound quantification techniques are available.

Figure 4



The potential benefits of this measure that can be realized by 2020 (as shown in Table 11) were estimated after first accounting for the benefits of the vehicle technology and efficiency measures in the plan. It was calculated based on the U.C. Berkeley study's median value of 4 percent per capita VMT reduction over a 10-year time horizon. This value should not be interpreted as the final estimate of the benefits of this measure. The current academic literature supports this realistic statewide estimate of potential benefits, but the ultimate benefit will be determined as an outcome of SB 375 implementation on a regional level. The incentives for sustainable planning in SB 375 can set California on a new path. ARB's establishment of regional targets in 2010, combined with the Regional Targets Advisory Committee process, required by the legislation, provides a clear mechanism for maximizing the benefits of this measure.

Additional Benefits of Regional Targets and Land Use Strategies

Land use and transportation measures that help reduce vehicle travel will also provide multiple benefits beyond greenhouse gas reductions. Quality of life will be improved

by increasing access to a variety of mobility options such as transit, biking, and walking, and will provide a diversity of housing options focused on proximity to jobs, recreation, and services. Other important state and community goals that could be met through better integrated land use and transportation planning include agricultural, open space and habitat preservation, improved water quality, positive health effects, and the reduction of smog forming pollutants.

Growing more sustainably has the potential to provide additional greenhouse gas and energy savings by encouraging more compact, mixed-use developments resulting in reduced demand for electricity and heating and cooling energy. These land use-related energy savings will contribute toward the Plan's energy efficiency measures to achieve the goal of reducing electricity and natural gas usage. ARB is continuing to evaluate the greenhouse gas emissions reductions that may be additional to the proposed measures in this plan.

Table 11: Regional Transportation-Related Greenhouse Gas Targets Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
T-3	Regional Transportation-Related Greenhouse Gas Targets[39]	5
	Total	**5**

7. Vehicle Efficiency Measures

Implement light-duty vehicle efficiency measures.

Several additional measures could reduce light-duty vehicle greenhouse gas emissions. The California Integrated Waste Management Board (CIWMB) with various partners continues to conduct a public awareness campaign to promote sustainable tire practices. ARB is pursuing a regulation to ensure that tires are properly inflated when vehicles are serviced. In addition, CEC in consultation with CIWMB is developing an efficient tire program focusing first on data gathering and outreach, then on potential adoption of minimum fuel-efficient tire standards, and lastly on the development of consumer information requirements for replacing tires. ARB is also pursuing ways to reduce engine load via lower friction oil and reducing the need for air conditioner use. ARB is actively engaged in the regulatory development process for the tire inflation component of this measure. Current information indicates the reduction of greenhouse gas emissions is likely to be less than estimated in the Draft Scoping Plan. ARB has adjusted the estimated reductions shown in Table 12 to reflect this.

[39] This number represents an estimate of what may be achieved from local land use changes. It is not the SB 375 regional target. ARB will establish regional targets for each MPO region following the input of the Regional Targets Advisory Committee and a public consultation process with MPOs and other stakeholders per SB 375.

Table 12: Vehicle Efficiency Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
T-4	Vehicle Efficiency Measures	4.5
	Total	**4.5**

8. Goods Movement

Implement adopted regulations for the use of shore power for ships at berth. Improve efficiency in goods movement activities.

A significant portion of greenhouse gas emissions from transportation activities comes from the movement of freight or goods throughout the state. Activity at California ports is forecast to increase by 250 percent between now and 2020. Both the Goods Movement Emission Reduction Plan (GMERP) and the 2007 State Implementation Plan (SIP) contain numerous measures designed to reduce the public health impact of goods movement activities in California. ARB has already adopted a regulation to require ship electrification at ports. Proposition 1B funds, as well as clean air plans being implemented by California's ports, will also help reduce greenhouse gas emissions while cutting criteria pollutant and toxic diesel emissions. ARB is proposing to develop and implement additional measures to reduce greenhouse gas emissions due to goods movement from trucks, ports and other related facilities. The anticipated reductions would be above and beyond what is already expected in the GMERP and the SIP. This effort should provide accompanying reductions in air toxics and smog forming emissions. The estimated reduction of greenhouse gas emissions is shown in Table 13.

After further evaluation, ARB incorporated the Draft Scoping Plan's Heavy-Duty Vehicle-Efficiency measure into the Goods Movement measure. A Heavy-Duty Engine Efficiency measure could reduce emissions associated with goods movement through improvements which could involve advanced combustion strategies, friction reduction, waste heat recovery, and electrification of accessories. ARB will consider setting requirements and standards for heavy-duty engine efficiency in the future if higher levels of efficiency are not being produced either in response to market forces (fuel costs) or federal standards.

Table 13: Goods Movement Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
T-5	Ship Electrification at Ports (Discrete Early Action)	0.2
T-6	Goods Movement Efficiency Measures • System-Wide Efficiency Improvements	3.5
	Total	**3.7**

9. Million Solar Roofs Program

Install 3,000 MW of solar-electric capacity under California's existing solar programs.

As part of Governor Schwarzenegger's Million Solar Roofs Program, California has set a goal to install 3,000 megawatts (MW) of new solar capacity by 2017 – moving the state toward a cleaner energy future and helping lower the cost of solar systems for consumers. The Million Solar Roofs Initiative is a ratepayer-financed incentive program aimed at transforming the market for rooftop solar systems by driving down costs over time. Created under Senate Bill 1 (Murray, Chapter 132, Statutes of 2006), the Million Solar Roofs Program includes CPUC's California Solar Initiative and CEC's New Solar Homes Partnership, and requires publicly-owned utilities (POUs) to adopt, implement and finance a solar incentive program. This measure would offset electricity from the grid, thereby reducing greenhouse gas emissions. The estimated emissions reductions are shown in Table 14.

Obtaining the incentives requires the building owners or developers to meet certain efficiency requirements: specifically, that new construction projects meet energy efficiency levels that exceed the State's Title 24 Building Energy Efficiency Standards, and that existing commercial buildings undergo an energy audit. Thus, the program is also a mechanism for achieving the efficiency targets for the Energy sector. By requiring greater energy efficiency for projects that seek solar incentives, the State would be able to reduce both electricity and natural gas needs and their associated greenhouse gas emissions.

Table 14: Million Solar Roofs Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
E-4	Million Solar Roofs (including California Solar Initiative, New Solar Homes Partnership and solar programs of publicly owned utilities) • Target of 3000 MW Total Installation by 2020	2.1
	Total	**2.1**

10. Medium/Heavy-Duty Vehicles

Adopt medium and heavy-duty vehicle efficiency measures.

Medium- and heavy-duty vehicles account for approximately 20 percent of the transportation greenhouse gas inventory. Requiring retrofits to improve the fuel efficiency of heavy-duty trucks could include a requirement for devices that reduce aerodynamic drag and rolling resistance. In addition, hybridization of medium- and

heavy-duty vehicles would also reduce greenhouse gas emissions through increased fuel efficiency. Hybrid trucks would likely achieve the greatest benefits in urban, stop-and-go applications, such as parcel delivery, utility services, transit, and other vocational work trucks. The recommendation for this sector is summarized in Table 15.

Table 15: Medium/Heavy-Duty Vehicle Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
T-7	Heavy-Duty Vehicle Greenhouse Gas Emissions Reduction Measure - Aerodynamic Efficiency (Discrete Early Action)	0.9
T-8	Medium/Heavy-Duty Vehicle Hybridization	0.5
	Total	**1.4**

11. Industrial Emissions

Require assessment of large industrial sources to determine whether individual sources within a facility can cost-effectively reduce greenhouse gas emissions and provide other pollution reduction co-benefits. Reduce greenhouse gas emissions from fugitive emissions from oil and gas extraction and gas transmission. Adopt and implement regulations to control fugitive methane emissions and reduce flaring at refineries.

Energy Efficiency and Co-Benefits Audits for Large Industrial Sources

This measure would apply to the direct greenhouse gas emissions at major industrial facilities emitting more than 0.5 MMTCO$_2$E per year. In general, these facilities also have significant emissions of criteria air pollutants, toxic air pollutants, or both. Major industrial facilities include power plants, refineries, cement plants, and miscellaneous other sources. ARB would implement this measure through a regulation, requiring each facility to conduct an energy efficiency audit of individual combustion and other direct sources of greenhouse gases within the facility to determine the potential reduction opportunities, including criteria air pollutants and toxic air contaminants. The audit would include an assessment of the impacts of replacing or upgrading older, less efficient units such as boilers and heaters, or replacing the units with combined heat and power (CHP) units. The measure is summarized in Table 16.

The audit would help ARB to identify potential reductions of greenhouse gas emissions reductions, the associated costs and cost-effectiveness, their technical feasibility, and the potential to reduce air pollution impacts at the local or regional level. ARB will use the results to determine if certain emissions sources within a facility can make cost-effective reductions of greenhouse gas emissions that also provide reductions in other criteria or toxic pollutants. Where this is the case, rule provisions or permit conditions would be considered to ensure the best combination

of pollution reductions. Nothing in this measure would delay known cost-effective strategies that otherwise would be required.

The California Long Term Energy Efficiency Strategic Plan (CPUC) discusses a number of strategies associated with improving industrial sector efficiency and greenhouse gas emissions reductions, including the development of certification protocols for industrial efficiency improvements to develop market recognition for efficiency gains.

Oil and Gas Recovery Operations and Transmission/Refineries

California is a major oil and gas producer. Crude oil, both from in-state and imported sources, is processed at 21 oil refineries in the state. In addition to conforming to the requirements of the cap-and-trade program and the audit measure, ARB has identified four specific measures for development and implementation, two for oil and gas recovery operations and gas transmission, and two for refineries. Other industrial measures that were under consideration affect greenhouse gas emissions sources that are fully regulated under cap and trade, which ARB concluded would provide cost-effective reductions of greenhouse gas emissions. All measures would be designed to secure a combination of cost-effective reductions in greenhouse gas emissions, criteria air pollutants and air toxics. Two measures would be developed to reduce methane emissions in the oil and gas production and gas transmission processes from leaks and incomplete combustion of methane (used as fuel). These measures would include improved leak detection, process modifications, equipment retrofits, installation of new equipment, and best management practices. The first measure would affect oil and gas producers. The second would impact operators of natural gas pipeline systems. These fugitive emissions are not proposed to be covered by a cap and trade program, although combustion-related emissions from these operations are proposed to be covered. The WCI partner jurisdictions are currently evaluating the inclusion of fugitive methane emissions to the extent that adequate quantification methods exist. During implementation of this measure, ARB will determine whether these emissions will also be covered in California's cap-and-trade program. If the emissions are covered under the cap, ARB will evaluate the need for the measures described here.

Two measures would be developed for oil refineries. The first would limit the greenhouse gas emissions from refinery flares while preserving flaring as needed for safety reasons. The second would remove the current fugitive methane exemption in most refinery Volatile Organic Compounds (VOC) regulations. This exemption was established because methane does not appreciably contribute to urban smog, but is inappropriate given the role that methane plays in global warming. ARB believes these measures would provide cost-effective greenhouse gas, criteria pollutants and air toxics emissions reductions. Most combustion and other process emissions at refineries would be governed by the cap-and-trade program. As with the oil and gas production measures above, the need for these measures would be evaluated if fugitive methane is included in the WCI cap-and-trade program.

Table 16: Industrial Emissions Recommendation
($MMTCO_2E$ in 2020)

Measure No.	Measure Description	Reductions
I-1	Energy Efficiency and Co-Benefits Audits for Large Industrial Sources	TBD
I-2	Oil and Gas Extraction GHG Emissions Reduction	0.2
I-3	GHG Leak Reduction from Oil and Gas Transmission	0.9
I-4	Refinery Flare Recovery Process Improvements	0.33
I-5	Removal of Methane Exemption from Existing Refinery Regulations	0.01
	Total	**1.4**

12. High Speed Rail

Support implementation of a high speed rail system.

A high speed rail (HSR) system is part of the statewide strategy to provide more mobility choice and reduce greenhouse gas emissions. This measure supports implementation of plans to construct and operate a HSR system between northern and southern California. As planned, the HSR is a 700-mile-long rail system capable of speeds in excess of 200 miles per hour on dedicated, fully-grade separated tracks with state-of-the-art safety, signaling and automated rail control systems. The system would serve the major metropolitan centers of California in 2030 and is projected to displace between 86 and 117 million riders from other travel modes in 2030.

For Phase 1 of the HSR, between San Francisco and Anaheim, 2020 is projected to be the first year of service, with 26 percent of the projected 2030 full system ridership levels. The anticipated reduction of greenhouse gas emissions are shown in Table 17. HSR system ridership and the benefits associated with it are anticipated to increase over time as additional portions of the planned system are completed. Over the long term, the system also has the potential to support the reduction of greenhouse gas emissions in the transportation sector from land use strategies, by providing opportunities for and encouraging low-impact transit-oriented development.

HSR implementation was initiated recently when California voters approved Proposition 1A, the "Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century," as it appeared on the November 2008 ballot. HSR is anticipated to begin in 2010, with full implementation anticipated in 2030.

Table 17: High Speed Rail Recommendation
($MMTCO_2E$ in 2020)

Measure No.	Measure Description	Reductions
T-9	High Speed Rail	1.0
	Total	**1.0**

13. Green Building Strategy

Expand the use of green building practices to reduce the carbon footprint of California's new and existing inventory of buildings.

Collectively, energy use and related activities by buildings are the second largest contributor to California's greenhouse gas emissions. Almost one-quarter of California's greenhouse gas emissions can be attributed to buildings.[40] As the Governor recognized in his Green Building Initiative (Executive Order S-20-04), significant reductions in greenhouse gas emissions can be achieved through the design and construction of new green buildings as well as the sustainable operation, retrofitting, and renovation of existing buildings.

A Green Building strategy offers a comprehensive approach to reducing direct and upstream greenhouse gas emissions that cross-cuts multiple sectors including Electricity/Natural Gas, Water, Recycling/Waste, and Transportation. Green buildings are designed, constructed, renovated, operated, and maintained using an integrated approach that reduces greenhouse gas emissions by maximizing energy and resource efficiency. Employing a whole-building design approach can create tremendous synergies that result in multiple benefits at little or no net cost, allowing for efficiencies that would never be possible on an incremental basis.

A Green Building strategy will produce greenhouse gas saving through buildings that exceed minimum energy efficiency standards, decrease consumption of potable water, reduce solid waste during construction and operation, and incorporate sustainable materials. Combined these measures can also contribute to healthy indoor air quality, protect human health and minimize impacts to the environment. A Green Building strategy also includes siting considerations. Buildings that are sited close to public transportation or near mixed-use areas can work in tandem with transportation-related strategies to decrease greenhouse gas emissions that result from that sector.

In July 2008, the California Building Standards Commission (CBSC) adopted the Green Building Standards Code (GBSC) for all new construction in the state. While the current version of the commercial green building code is voluntary, CBSC anticipates adopting a mandatory code in 2011 which will institute minimum environmental performance standards for all occupancies. The Green Building Strategy includes Zero Net Energy (ZNE) goals for new and existing homes and commercial buildings consistent with the recently-adopted California Long Term Energy Efficiency Strategic Plan. ARB encourages local governments to raise the bar by adopting "beyond-code" green building requirements. To assist this effort, State government would develop and regularly tighten voluntary standards, written in GBSC language for easy adoption by local jurisdictions.

[40] Greenhouse gas emission estimates from electricity, natural gas, and water use in homes and commercial buildings.

As we approach the 2020 and 2030 targets for zero energy buildings, these "percent above code" targets must shift to "percent of ZNE" targets. Zero energy new and existing buildings can be an overarching and unifying concept for energy efficiency in buildings, as discussed above (building energy efficiency measures E-1 and CR-1). In order to achieve statewide GHG emission reductions, these targets should be expanded to address other aspects of environmental performance. For example, these targets could be re-framed as a carbon footprint reduction goal for a 35 percent reduction in both energy and water consumption. For commercial buildings, a 2011 target should be established such that a quarter of all new buildings reduce energy and water consumption by at least 25 percent beyond code.

Furthermore, retrofitting existing residential and commercial buildings would achieve substantial greenhouse gas emissions reduction benefits. This Scoping Plan recommends the establishment of an environmental performance rating system for homes and commercial buildings and further recommends that California adopt mechanisms to encourage and require retrofits for buildings that do not meet minimum standards of performance.

An effective green building framework can operate to deliver reductions of greenhouse gas emissions in multiple sectors. The green building strategies provide a vehicle to achieve the statewide electricity and natural gas efficiency targets and lower greenhouse gas emissions from the waste and water transport sectors. Achieving these green building emissions reductions will require coordinated efforts from a broad range of stakeholders, and new financing mechanisms to motivate investment in green building strategies.

Achieving significant greenhouse gas emissions reductions from new and existing buildings will require a combination of green building measures for new construction and retrofits to existing buildings. The State of California will set an example by requiring all new State buildings to exceed existing Green Building Initiative energy goals and achieve nationally-recognized building sustainability standards such as Leadership in Energy and Environmental Design - New Construction (LEED-NC) "Gold" certification. Existing State buildings would also be retrofitted to achieve higher standards equivalent to LEED-EB for existing buildings (EB) "Silver." All new schools should be required to meet the Collaborative for High Performance Schools (CHPS) 2009 criteria. Existing schools applying for modernization funds should also be required to meet CHPS 2009 criteria.

ARB estimates that the greenhouse gas savings from green building measures as approximately 26 $MMTCO_2E$, as shown in Table 18 below. Most of these reductions are accounted for in the Electricity, Waste and Water sectors. Because of this, ARB has assigned all emissions reductions that occur as a result of green building strategies to other sectors for purposes of meeting AB 32 requirements, but will continue to evaluate and refine the emissions from this sector. As such, this strategy will require implementation from various entities within California, including CEC,

PUC, State Architect, and others, each taking the lead in their area of authority and expertise.

Table 18: Green Buildings Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
GB-1	Green Buildings[41]	26
	Total	**26**

14. High Global Warming Potential Gases

Adopt measures to reduce high global warming potential gases.

High global warming potential (GWP) gases pose a unique challenge. Just a few pounds of high GWP materials can have the equivalent effect on global warming as several *tons* of carbon dioxide. For example, the average refrigerator has about a half-pound of refrigerant and about one pound of "blowing agents" used to make the insulating foam. If these gases were released into the atmosphere, they would have a global warming impact equivalent to five metric tons of CO_2.

High GWP chemicals are very common and are used in many different applications such as refrigeration, air conditioning systems, fire suppression systems, and the production of insulating foam. Because these gases have been in use for years, old refrigerators, air conditioners and foam insulation represent a significant "bank" of these materials yet to be released. High GWP gases are released primarily in two ways. The first is through leaking systems, and the second is during the disposal process. Once high GWP materials are released, they persist in the atmosphere for tens or even hundreds of years. Recommended measures to address this growing problem take the form of direct regulations and use of mitigation fees.

ARB identified four Discrete Early Action measures to reduce greenhouse gas emissions from the refrigerants used in car air conditioners, semiconductor manufacturing, air quality tracer studies, and consumer products. ARB has identified additional potential reduction opportunities based on specifications for future commercial and industrial refrigeration, changing the refrigerants used in auto air conditioning systems, and ensuring that existing car air conditioning systems as well as stationary refrigeration equipment do not leak. Recovery and destruction of high GWP materials in the banks described above could also provide significant reductions.

[41] Although some of these emissions reductions may be additional, most of them are accounted for in the Energy, Waste, Water, and Transportation sectors. In addition, some of these reductions may occur out of state, making quantification more difficult. Because of this, these emissions reductions are not currently counted toward the AB 32 2020 goal.

ARB is also proposing to establish an upstream mitigation fee on the use of high GWP gases. Even with the reductions from the specific high GWP measures described above, this sector's emissions are still projected to more than double from current levels by 2020. This is because of the high growth in the sector due, in part, to the replacement of ozone-depleting substances being phased out of production. These emissions would be difficult to address via traditional approaches since the gases are used in small quantities in very diverse applications. Additionally, there are no proven substitutes or alternatives for some uses, and the relative low price of most high GWP compounds provides little incentive to develop alternatives, reduce leakage, or recover the gases at end-of-life.

An upstream fee would ensure that the climate impact of these substances is reflected in the total cost of the product, encouraging reduced use and end-of-life losses, as well as the development of alternatives. The fee would be variable and associated with the impact the product makes on public health and the environment. This could encourage product innovation because fees would correspondingly decrease as the manufacturer or producer redesigned their product or found lower-cost alternatives. This mitigation fee would complement many of the downstream high GWP regulations currently being developed.[42] Fees on high GWP gases would be set to be consistent with the cost of reducing greenhouse gas emissions and could be set to reduce multiple environmental impacts. Revenues could be used to mitigate greenhouse gas emissions either from other high GWP compounds or other greenhouse gases.

Table 19 summarizes the recommendations for measures in the High GWP sector. These measures address both high GWP gases identified in AB 32 and also other high GWP gases, such as ozone-depleting substances that are only partially covered by the Montreal Protocol. The emissions reductions shown are only for the six greenhouse gases explicitly identified in AB 32.

[42] Industrial process emissions of high GWP gases are also expected to be part of the cap-and-trade program. As ARB moves through the rulemaking for both the high GWP fee and the cap-and-trade program, staff will evaluate whether these are complementary approaches or if one or the other needs to be adjusted to prevent duplicative regulation of the industrial process emissions of these gases.

Table 19: High GWP Gases Sector Recommendation
($MMTCO_2E$ in 2020)

Measure No.	Measure Description	Reductions
H-1	Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing (Discrete Early Action)	0.26
H-2	SF_6 Limits in Non-Utility and Non-Semiconductor Applications (Discrete Early Action)	0.3
H-3	Reduction of Perfluorocarbons in Semiconductor Manufacturing (Discrete Early Action)	0.15
H-4	Limit High GWP Use in Consumer Products (Discrete Early Action) (Adopted June 2008)	0.25
H-5	High GWP Reductions from Mobile Sources • Low GWP Refrigerants for New Motor Vehicle Air Conditioning Systems • Air Conditioner Refrigerant Leak Test During Vehicle Smog Check • Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers • Enforcement of Federal Ban on Refrigerant Release during Servicing or Dismantling of Motor Vehicle Air Conditioning Systems	3.3
H-6	High GWP Reductions from Stationary Sources • High GWP Stationary Equipment Refrigerant Management Program: o Refrigerant Tracking/Reporting/Repair Deposit Program o Specifications for Commercial and Industrial Refrigeration Systems • Foam Recovery and Destruction Program • SF_6 Leak Reduction and Recycling in Electrical Applications • Alternative Suppressants in Fire Protection Systems • Residential Refrigeration Early Retirement Program	10.9
H-7	Mitigation Fee on High GWP Gases[43]	5
	Total	**20.2**

[43] The 5 $MMTCO_2E$ reduction is an estimate of what might occur with a fee in place. Additional emissions reductions from a fee would be expected as resulting revenues are used in mitigation programs. Using the funds to mitigate greenhouse gas emissions could substantially increase the emissions reductions from this measure.

15. Recycling and Waste

Reduce methane emissions at landfills. Increase waste diversion, composting and other beneficial uses of organic materials, and mandate commercial recycling. Move toward zero-waste.

California has a long track record of reducing greenhouse gas emissions by turning waste into resources, exemplified by the waste diversion rate from landfills of 54 percent (which exceeds the current 50 percent mandate) resulting from recovery of recyclable materials. Re-introducing recyclables with intrinsic energy value back into the manufacturing process reduces greenhouse gas emissions from multiple phases of product production including extraction of raw materials, preprocessing and manufacturing. Additionally, by recovering organic materials from the waste stream, and having a vibrant composting and organic materials industry, there is an opportunity to further reduce greenhouse gas emissions through the indirect benefits associated with the reduced need for water and fertilizer for California's Agricultural sector. Incentives may also be an effective way to secure greenhouse gas emissions reductions in this sector. Table 20 summarizes the emissions reductions from Recycling and Waste sector.

Reduction in Landfill Methane

Methane emissions from landfills, generated when wastes decompose, account for one percent of California's greenhouse gas emissions. Greenhouse gas emissions can be substantially reduced by properly managing all materials to minimize the generation of waste, maximize the diversion from landfills, and manage them to their highest and best use. Capturing landfill methane results in greenhouse gas benefits, as well as reductions in other air pollutants such as volatile organic compounds. ARB is working closely with the California Integrated Waste Management Board (CIWMB) to develop a Discrete Early Action measure for landfill methane control that will be presented to ARB in January.

CIWMB is also pursuing efforts to reduce methane emissions by diverting organics from landfills, and to promote best management practices at smaller uncontrolled landfills. Landfill gas may also provide a viable source of liquefied natural gas (LNG) vehicle fuel. Reductions from these types of projects would be accounted for in the Transportation sector.

High Recycling / Zero Waste

This measure reduces greenhouse gas emissions primarily by reducing the substantial energy use associated with the acquisition of raw materials in the manufacturing stage of a product's life-cycle. As virgin raw materials are replaced with recyclables, a large reduction in energy consumption should be realized. Implementing programs with a systems approach that focus on consumer demand, manufacturing, and movement of products will result in the reduction of greenhouse gas emissions and other co-benefits. Reducing waste and materials at the source of generation,

increased use of organic materials to produce compost to benefit soils and to produce biofuels and energy, coupled with increased recycling – especially in the commercial sector – and Extended Producer Responsibility (EPR) plus Environmentally Preferable Purchasing (EPP) also have the potential to reduce emissions, both in-state and within the connected global economy. This measure could also assist in meeting the 33 percent renewables energy goal through deployment of anaerobic digestion for production of fuels/energy.

As noted by ETAAC, recycling in the commercial sector could be substantially increased. This will be implemented through mandatory programs and enhanced partnerships with local governments. The provision of appropriate financial incentives will be critical. ARB will work with CIWMB to develop and implement these types of programs. ARB will also work with CIWMB, the California Department of Food and Agriculture, the Department of Transportation, and others to provide direct incentives for the use of compost in agriculture and landscaping. Further, CIWMB will explore the use of incentives for all Recycling and Waste Management measures, including for commercial recycling and for local jurisdictions to encourage the collection of residentially and commercially-generated food scraps for composting and in-vessel anaerobic digestion.

Table 20: Recycling and Waste Sector Recommendation - Landfill Methane Capture and High Recycling/Zero Waste

(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
RW-1	Landfill Methane Control (Discrete Early Action)	1
RW-2	Additional Reductions in Landfill Methane • Increase the Efficiency of Landfill Methane Capture	TBD
RW-3	High Recycling/Zero Waste • Mandatory Commercial Recycling • Increase Production and Markets for Organics Products • Anaerobic Digestion • Extended Producer Responsibility • Environmentally Preferable Purchasing	 5 2 2 TBD TBD
	Total	**10**[(44)]

[44] Reductions from RW-2 and RW-3 are not counted toward the AB 32 goal. ARB is continuing to work with CIWMB to quantify these emissions and determine what portion of the reductions can be credited to meeting the AB 32 2020 goal. These measures may provide greater emissions reductions than estimated.

16. Sustainable Forests

Preserve forest sequestration and encourage the use of forest biomass for sustainable energy generation.

The 2020 Scoping Plan target for California's forest sector is to maintain the current 5 $MMTCO_2E$ of sequestration through sustainable management practices, potentially including reducing the risk of catastrophic wildfire, and the avoidance or mitigation of land-use changes that reduce carbon storage. California's Board of Forestry and Fire Protection has the existing authority to provide for sustainable management practices, and will, at a minimum, work to maintain current carbon sequestration levels. The Resources Agency and its departments will also have an important role to play in implementing this measure.

In addition, the Resources Agency is supporting voluntary actions, including expenditure of public funds for projects focused largely on conserving biodiversity, providing recreation, promoting sustainable forest management and other projects that also provide carbon sequestration benefits. The federal government must also use its regulatory authority to, at a minimum, maintain current carbon sequestration levels for land under its jurisdiction in California.

Forests in California are now a carbon sink. This means that atmospheric removal of carbon through sequestration is greater than atmospheric emissions from processes like fire and decomposition of wood. However, several factors, such as wildfires and forest land conversion, may cause a decline in the carbon sink. The 2020 target would provide a mechanism to help ensure that current carbon stocks are, at a minimum, maintained and do not diminish over time. The 5 $MMTCO_2E$ emission reduction target is set equal to the magnitude of the current estimate of net emissions from California's forest sector. As technical data improve, the target can be recalibrated to reflect new information.

California's forests will play an even greater role in reducing carbon emissions for the 2050 greenhouse gas emissions reduction goals. Forests are unique in that planting trees today will maximize their sequestration capacity in 20 to 50 years. As a result, near-term investments in activities such as planting trees will help us reach our 2020 target, but will also play a greater role in reaching our 2050 goals.

Monitoring carbon sequestered on forest lands will be necessary to implement the target. The Board of Forestry and Fire Protection, working with the Resources Agency, the Department of Forestry and Fire Protection and ARB would be tasked with developing a monitoring program, improving greenhouse gas inventories, and determining what actions are needed to meet the 2020 target for the Forest sector. Future climate impacts will exacerbate existing wildfire and insect disturbances in the Forest sector. These disturbances will create new uncertainties in reducing emissions and maintaining sequestration levels over the long-term, requiring more creative strategies for adapting to these changes. In the short term, focusing on sustainable management practices and land-use issues is a practical approach for moving forward.

Future land use decisions will play a role in reaching our greenhouse gas emissions reduction goals for all sectors. Loss of forest land to development increases greenhouse gas emissions levels because less carbon is sequestered. Avoiding or mitigating such conversions will support efforts to meet the 2020 goal. When significant changes occur, the California Environmental Quality Act is a mechanism providing for assessment and mitigation of greenhouse gas emissions.

Going forward there are a number of forestry-related strategies that can play an important role in California's greenhouse gas emissions reduction efforts. Biomass resources from forest residue will factor into the expansion of renewable energy sources (this is currently accounted for in the Energy sector). Similarly, fuels management strategies have the potential to reduce the risk of catastrophic fires. However, fuels management needs to be evaluated to determine whether, and if so under what circumstances, quantifiable greenhouse gas emission reductions are achieved. Additionally, public investments to purchase and preserve forests and woodlands would also provide greenhouse gas emission reductions that will be accounted for as projects are funded. Urban forest projects can also provide the dual benefit of carbon sequestration and shading to reduce air conditioning load.

Furthermore, the Forest sector currently functions as a source of voluntary reductions that would not otherwise occur and this role could expand even further in the future. ARB has already adopted a methodology to quantify reductions from forest projects, and recently adopted additional quantification methodologies. Table 21 summarizes the emission reductions from the forest measure.

Table 21: Sustainable Forests Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
F-1	Sustainable Forest Target	5
	Total	**5**

17. Water

Continue efficiency programs and use cleaner energy sources to move and treat water.

Water use requires significant amounts of energy. Approximately one-fifth of the electricity and one-third of the non-power plant natural gas consumed in the state are associated with water delivery, treatment and use. Although State, federal, and local water projects have allowed the state to grow and meet its water demands, greenhouse gas emissions can be reduced if we can move, treat, and use water more efficiently. As is the case with energy efficiency, California has a long history of advancing water efficiency and conservation programs. Without this ongoing, critical work,

baseline or business-as-usual greenhouse gas emissions associated with water use would be much higher than is currently the case.

Six greenhouse gas emissions reduction strategies measures are proposed for the Water sector, and are shown in Table 22. Three of the measures target reducing energy requirements associated with providing reliable water supplies and two measures are aimed at reducing the amount of non-renewable electricity associated with conveying and treating water. The final measure focuses on providing sustainable funding for implementing these actions. The greenhouse gas emissions reductions from these measures are indirectly realized through reduced energy requirements and are accounted for in the Electricity and Natural Gas sector.

In addition, a mechanism to make allowances available in a cap-and-trade program could be used to provide additional incentives for local governments, water suppliers, and third party providers to bundle water and energy efficiency improvements. This type of allowance set-aside will be evaluated during the rulemaking for the cap-and-trade program.

ARB recommends a public goods charge for funding investments in water management actions that improve water and energy efficiency and reduce GHG emissions. As noted by the Economic and Technology Advancement Advisory Committee, a public goods charge on water can be collected on water bills and then used to fund end-use water efficiency improvements, system-wide efficiency projects, water recycling, and other actions that improve water and energy efficiency and reduce GHG emissions. Depending on how the fee schedule is developed in a subsequent rulemaking process, a public goods charge could generate $100 million to $500 million. These actions would also have the co-benefit of improving water quality and water supply reliability for customers.

Table 22: Water Recommendation
($MMTCO_2E$ in 2020)

Measure No.	Measure Description	Reductions
W-1	Water Use Efficiency	1.4
W-2	Water Recycling	0.3
W-3	Water System Energy Efficiency	2.0
W-4	Reuse Urban Runoff	0.2
W-5	Increase Renewable Energy Production	0.9
W-6	Public Goods Charge	TBD
	Total	**4.8**[45]

[45] Greenhouse gas emission reductions from the water sector are not currently counted toward the 2020 goal. ARB anticipates that a portion of these reductions will be additional to identified reductions in the Electricity sector and is working with the appropriate agencies to refine the electricity/water emissions inventory.

18. Agriculture

In the near-term, encourage investment in manure digesters and at the five-year Scoping Plan update determine if the program should be made mandatory by 2020.

Encouraging the capture of methane through use of manure digester systems at dairies can provide emission reductions on a voluntary basis. This measure is also a renewable energy strategy to promote the use of captured gas for fuels or power production. Initially, economic incentives such as marketable emission reduction credits, favorable utility contracts, or renewable energy incentives will be needed. Quantified reductions for this measure (shown in Table 23) are not included in the sum of statewide reductions shown in Table 2 since the initial approach is voluntary. ARB and the California Climate Action Registry worked together on a manure digester protocol to establish methods for quantifying greenhouse gas emissions reductions from individual projects; the Board adopted this protocol in September 2008. The voluntary approach will be re-assessed at the five-year update of the Scoping Plan to determine if the program should become mandatory for large dairies by 2020.

Nitrogen fertilizer, which produces N_2O emissions, is the other significant source of greenhouse gases in the Agricultural sector. ARB has begun a research program to better understand the variables affecting fertilizer N_2O emissions (Phase 1), and based on the findings, will explore opportunities for emission reductions (Phase 2).

There may be significant potential for additional voluntary reductions in the agricultural sector through strategies, such as those recommended by ETAAC. These opportunities include increases in fuel efficiency of on-farm equipment, water use efficiency, and biomass utilization for fuels and power production.

Increasing carbon sequestration, including on working rangelands, hardwood and riparian woodland reforestation, also hold potential as a greenhouse gas strategies. As we evaluate the role that this sector can play in California's emissions reduction efforts, we will explore the feasibility of developing sound quantification protocols so that these and other related strategies may be employed in the future.

Table 23: Agriculture Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
A-1	Methane Capture at Large Dairies[46]	1.0
	Total	**1.0**

[46] Because the emission reductions from this measure are not required, they are not counted in the total.

D. Voluntary Early Actions and Reductions

Many individual activities that are not currently addressed under regulatory approaches can nevertheless result in cost-effective, real, additional, and verifiable greenhouse gas emissions reductions that will help California meet its 2020 target. Ensuring that appropriate credit is available to these types of emissions reduction projects will also help jump-start a new wave of technologies that will feature prominently in California and the world's long-term efforts to combat climate change. ARB will pursue several approaches that will recognize and reward these types of projects.

1. Voluntary Early Action

ARB is required to design regulations to encourage early action to reduce greenhouse gas emissions, and to provide appropriate recognition or credit for that action. (HSC §38562(b)(1) and (3)) Recognizing and rewarding greenhouse gas emissions reductions that occur prior to the full implementation of the AB 32 program can set the stage for innovation by incentivizing the development and employment of new clean technologies and by generating economic and environmental benefits for California.

In February 2008, ARB adopted a policy statement encouraging the early reductions of greenhouse gas emissions.[47] The policy statement describes a process for interested parties to submit proposed emission quantification methodologies for voluntary greenhouse gas emissions reductions to ARB for review. The intent is to provide a rapid assessment of methodologies for evaluating potential greenhouse gas emissions reduction projects to encourage early actions. Where appropriate, ARB will issue Executive Orders to confirm the technical soundness of the methodologies, and the methodology would be available for use by other parties to demonstrate the creation of voluntary early reductions. ARB is currently in the process of evaluating a number of submitted project methodologies.

ARB will provide appropriate credit for voluntary early reductions that can be adequately quantified and verified through three primary means. First, within the cap-and-trade program, ARB would set aside a certain number of allowances from the first compliance period to use to reward voluntary reductions that occur before 2012. In addition, ARB will assure that the allocation process in the first compliance period does not disadvantage facilities that have made reductions after AB 32 went into effect at the start of 2007 and before 2012.[48] The third approach will be to design

[47] Board Meeting Agenda. California Air Resources Board. February 28, 2008. http://www.arb.ca.gov/board/ma/2008/ma022808.htm (accessed October 12, 2008)

[48] ARB will evaluate whether some reductions that occurred prior to AB 32 going into effect on January 1, 2007, should also receive credit under these rules. For example, many facilities in California registered with the California Climate Action Registry after its creation in 2002 to document early actions to reduce emissions by having a record of entities profiles and baselines. ARB will evaluate what reductions made prior to 2007 should be eligible for credit from the allowance set-aside as part of the cap-and-trade program rulemaking.

other regulations, to the extent feasible, to recognize and reward early action. These approaches are discussed in more detail in Appendix C.

2. Voluntary Reductions

Emissions reduction projects that are not otherwise regulated, covered under an emissions cap, or undertaken as a result of government incentive programs can generate "offsets." These are verifiable reductions whose ownership can be transferred to others. Voluntary offset markets have recently flourished as a way for companies and individuals to offset their own emissions by purchasing reductions outside of their own operations. These sorts of voluntary efforts to reduce greenhouse gas emissions can play an important role in helping the State meet its overall greenhouse gas reduction goals.

ARB will adopt methodologies for quantifying voluntary reductions. (HSC §38571) The Board adopted a methodology for forest projects in October 2007 and for urban forestry and manure digesters in September 2008. The recognition of voluntary reduction or offset methodologies does not in any way guarantee that these offsets can be used for other compliance purposes. The Board would need to adopt regulations to verify and enforce reductions achieved under these or other approved methodologies before they could be used for compliance purposes. (HSC §38571)

Allowance set-asides, in addition to being used to potentially reward voluntary early actions by facilities that will be included in the cap-and-trade program, could also be used to reward voluntary early action at other facilities not covered by the cap and to ensure that voluntary actions, such as voluntary renewable power purchases by individuals, businesses, and others, serve to reduce greenhouse gas emissions under the cap. An early action allowance set-aside could be utilized both by entities that are covered by the cap, and by those who develop emissions reducing projects outside of the cap, or purchase the reductions associated with those projects, and have not sold or used them. Additional discussion of voluntary offsets is included in Appendix C.

E. Use of Allowances and Revenues

Revenues may be generated from the implementation of various proposed components of the Scoping Plan, including by the use of auctions within a cap-and-trade system or through the imposition of more targeted measures, such as a public goods charge on water. These revenues could be used to support AB 32 requirements for greenhouse gas emissions reductions and associated socio-economic considerations. This section summarizes some of the recommendations and ideas that ARB has received to date. As discussed in the description of the cap-and-trade measure above, ARB will seek input from a broad range of experts in an open public process regarding the options for allocation and revenue use under consideration.

The Economic and Technology Advancement Advisory Committee (ETAAC) recommended the creation of a California Carbon Trust as a possible mechanism for using revenues

generated by the program, leveraged with private funds, to further the overall program goals. ETAAC's recommendation is roughly based on the United Kingdom Carbon Trust. The United Kingdom program was established with public funds, but now functions as a stand-alone corporation, providing management and consulting services to corporations and small and medium businesses on reducing greenhouse gas emissions. It also funds innovations in carbon reduction technologies. ETAAC recommended the creation of a similar organization that would use revenue from the sale of carbon allowances or from carbon fees to:

- Fund research, development and demonstration projects,
- Help bring promising and high potential technologies through the often challenging early stages of development and get them to market,
- Manage the early carbon market and mitigate price volatility, purchasing credits and selling them or retiring them as needed,
- Dedicate resources to fund projects to achieve AB 32 Environmental Justice goals, or
- Support a green technology workforce training program.

The most appropriate use for some of the allowances and revenue generated under AB 32 may be to retain it within or return it to the sector from which it was generated. For example, CEC and CPUC specifically recommended that significant portions of the revenue generated from the electricity sector under a cap-and-trade program be used for the benefit of that sector to support investments in renewable energy, efficiency, new energy technology, infrastructure, customer utility bill relief, and other similar programs. In the case of more targeted revenues from a public goods charge, the intent would be to use the funds for program purposes within the sector in which it was raised, for example in the water sector. ARB will seek input from a broad range of experts in an open public process, and will work with other agencies, the WCI partner jurisdictions, and stakeholders to consider the options for use of revenues from the AB 32 program.

Possible uses of allowances and of the revenue generated under the program include:

- **Reducing costs of emissions reductions or achieving additional reductions –** Funding energy efficiency and renewable resource development could lower overall costs to consumers and companies, and provide the opportunity to achieve greater emissions reductions than would otherwise be possible. Program revenues could be used to fund programs directly, or create financial incentives for others. Allowance set-asides could also be used to provide incentives for voluntary renewable power purchases by individuals and businesses, and for increased energy efficiency.
- **Achieving environmental co-benefits –** Criteria and toxic air pollutants create health risks, and some communities bear a disproportionate burden from air pollution. Revenues could be used to enhance greenhouse gas emission reductions that also provide reductions in air and other pollutants that affect public health.

- **Incentives to local governments –** Funding or other incentives to local governments for well-designed land-use planning and infrastructure projects could lead to shorter commutes and encourage walking, bicycling and the use of public transit. Funding of other incentives for local governments could also be used to increase recycling, composting, and to generating renewable energy from anaerobic digestion.
- **Consumer rebates –** Utilities and other businesses could use revenues to support and increase rebate programs to customers to offset some of the cost associated with increased investments in renewable resources and to encourage increased energy efficiency.
- **Direct refund to consumers –** Revenue from the program could be recycled directly back to consumers in a variety of forms including per capita dividends, earned income tax credits, or other mechanisms.
- **Climate change adaptation programs –** Climate change will impact natural and human environments. Program revenues could be used to help the state adapt to the effects of climate change which will be detailed in the State's Climate Adaptation Strategy being prepared by the Resources Agency to be completed in early 2009.
- **Subsidies –** Revenues could be used to reduce immediate cost impacts to covered industries required to make substantial upfront capital investments to reduce greenhouse gas emissions.
- **RD&D funding –** Revenues could be used to support research, development, and deployment of green technologies.
- **Worker transition assistance –** Regulating greenhouse gas emissions will probably shift economic growth to some sectors and green technologies and away from higher carbon intensity industries. Worker training programs could help the California labor force be competitive in these new industries.
- **Administration of a greenhouse gas program –** A portion of revenues could be used to underwrite the State's AB 32 programs and operating costs.
- **Direct emission reductions –** Revenues could be used to purchase greenhouse gas reductions for the sole purpose of retirement, providing direct additional greenhouse gas emission reductions. Potential projects, such as afforestation and reforestation, would both sequester CO_2 and provide other environmental benefits.

Many of the potential uses of revenue would help ARB implement the community benefit section of the AB 32 (HSC §38565) which directs the Board, where applicable and to the extent feasible, to ensure that the greenhouse gas emissions reduction program directs public and private investment toward the most disadvantaged communities in California.

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III. EVALUATIONS

The primary purpose of the Scoping Plan is to develop a set of measures that will provide the maximum technologically feasible and cost-effective greenhouse gas emission reductions. In developing this Plan, ARB evaluated the effect of these measures on California's economy, environment, and public health. This Chapter outlines these analyses.

ARB conducted broad evaluations of the potential impacts of the Scoping Plan, and will conduct more specific evaluations during regulatory development (HSC §38561(d), and HSC §38562(b)). Prior to inclusion of market-based compliance mechanisms in a regulation, to the extent feasible, the Board will consider direct, indirect and cumulative emission impacts, and localized impacts in communities that are already adversely impacted by air pollution (HSC §38570(b)).

Based on the evaluation of the recommendations included in this Plan, implementing AB 32 is expected to have an overall positive effect on the economy. In addition, implementation of the measures in the Recommended Actions section (Chapter II) will reduce statewide oxides of nitrogen (NOx), volatile organic compounds (VOC) and atmospheric particulate matter (PM) emissions primarily due to reduced fuel consumption, with resulting public health benefits. ARB will also work at the measure-specific level to further maximize the public health benefits that can accompany implementation of greenhouse gas emissions reduction strategies. The following sections provide a summary of the ARB evaluations of the recommended measures included in this Scoping Plan. More detailed information on the evaluations and their results are provided in Appendices G and H.

A. Economic Modeling

To evaluate the economic impacts of the Scoping Plan, ARB compared estimated economic activity under a business-as usual (BAU) case to the results obtained when actions recommended in this Plan are implemented. The BAU case is briefly described below. The estimated costs and savings used as model inputs for individual measures are outlined in Appendix G, and additional documentation on the calculation of those costs and savings is provided in Appendix I. All dollar estimates are in 2007 dollars.

Under the BAU case, Gross State Product (GSP) in California is projected to increase from $1.8 trillion in 2007 to almost $2.6 trillion in 2020. The results of our economic analysis indicate that implementation of the Scoping Plan will have an overall positive net economic benefit for the state. Positive impacts are anticipated primarily because the investments motivated by several measures result in substantial energy savings that more than pay back the cost of the investments at expected future energy prices.

The business-as-usual case is a representation of what the State of the California economy will be in the year 2020 assuming that none of the measures recommended in the Scoping Plan are implemented. While a number of the measures in the plan will be implemented as the result of existing federal or State policies and do not require additional regulatory action resulting from the implementation of AB 32, they are not included in the BAU case to ensure that the economic impacts of all of the measures in the Scoping Plan are fully assessed.

The BAU case is constructed using forecasts from the California Department of Finance, the California Energy Commission, and other sources, and is described in more detail in Appendix G. ARB used a conservative estimate of future petroleum price in this analysis, $89 per barrel of oil in 2020. Aspects of the BAU case are subject to uncertainty, for example, the possibility that future energy prices could deviate from those that are included in the BAU case.

1. Macro-economic Modeling Results

Table 24 summarizes the key findings from the economic modeling. Gross State Product, personal income and employment are shown for 2007 and for two cases for 2020, the BAU case and for implementation of the Scoping Plan. For both the BAU case and the Scoping Plan case, Gross State Product increases by almost $800 billion between 2007 and 2020, personal income grows by 2.8 percent per year from $1.5 trillion in 2007 to $2.1 trillion in 2020, and employment grows by 0.9 percent per year from 16.4 million jobs in 2007 to 18.4 million (BAU) or 18.5 million (Scoping Plan) in 2020. The results consistently show that implementing the Scoping Plan will not only significantly reduce California's greenhouse gas emissions, but will also have a net positive effect on California's economic growth through 2020.

Table 24: Summary of Key Economic Findings from Modeling the Scoping Plan Using E-DRAM

Economic Indicator	2007	Business-as-Usual*		Scoping Plan		
		2020	Average Annual Growth	2020	Change from BAU	Average Annual Growth
Gross State Product ($Billion)	1,811	2,586	2.8%	2,593	0.3%	2.8%
Personal Income ($Billion)	1,464	2,093	2.8%	2,109	0.8%	2.8%
Employment (Million Jobs)	16.41	18.41	0.9%	18.53	0.7%	0.9%
Emissions ($MMTCO_2E$)	500**	596	1.4%**	422	-28%	-1.2%**
Carbon Prices (Dollars)	-	-	-	10.00	NA	-

* Business-as-usual is a forecast of the California economy in 2020 without implementation of any of the measures identified in the Scoping Plan.

** Approximate value. ARB is in currently estimating greenhouse gas emissions for 2007.

The macroeconomic modeling results presented here understate the benefits of market-based policies, including the cap-and-trade program. Consequently, our estimate of the economic impact of implementing the Scoping Plan understates the positive impact on the California economy. Nonetheless, using the current best estimates of the costs and savings of the measures, which are documented in Appendix I, the models demonstrate that implementing the Plan will have a positive effect on California's economy.

The modeling results reflect a carbon price for the cap-and-trade program of $10 per-ton. It is important to note that the $10 per-ton figure does not reflect the average cost of reductions; rather it is the *maximum* price at which reductions to achieve the cap are pursued based on the marketing program.

The positive impacts are largely attributable to savings that result from reductions in expenditures on energy. These savings translate into increased consumer spending on goods and services other than energy. Many of the measures entail more efficient use of energy in the economy, with savings that exceed their costs. In this way, investment in energy efficiency results in money pumped back into local economies. Table 25 summarizes the energy savings that are projected from implementation of the Scoping Plan. These savings are estimated to exceed $20 billion annually by 2020.

Table 25: Fuels and Electricity Saved in 2020 from Implementation of the Scoping Plan

	Gasoline	Diesel	Electricity	Natural Gas*
Use Avoided**	4,600 million gallons	670 million gallons	74,000 GWh	3,400 million therms
Value of Avoided Fuel Use (Million $2007)	$17,000	$2,500	$6,400***	$2,700
Percent Reduction from BAU	25%	17%	22%****	24%

* Not including natural gas for electric generation.

** These estimates are based on reduced use of these fuels due to increased efficiencies, reduced vehicle miles travelled, etc. Changes to the fuel mix, such as those called for under the RPS or the LCFS, are not included here. These estimates are not the same as the estimates of reduced fuel consumption used in the public health analysis.

*** Based on estimated avoided cost based on average base-load electricity, including generation, transmission and distribution.

**** This is as a percentage of BAU total California electricity consumption in 2020.

2. Impact on Specific Business Sectors

As indicated in Table 26 and Table 27, the effects of the Plan are not uniform across sectors. Implementation of the Scoping Plan would have the strongest positive impact on output and employment for the agriculture, forestry and fishing sector, the

finance, insurance and real estate sector, and the mining sector. Similar to the statewide economic impacts projected by the model, however, these results also indicate that relative to the business-as-usual case, the impacts due to implementation of the Plan change current growth projections for most sectors by only very small amounts.

Table 26 and Table 27 also show that a decrease in output is projected for the utility and retail trade sectors as compared to the business-as-usual case, and a decrease in employment is projected for the utility sector. In the utility sector, the modeling indicates that implementation of the Scoping Plan would significantly reduce the need for additional power generation and natural gas consumption, which subsequently reduces the growth in output for this sector. This results in a reduction from business-as-usual for economic output and employment of approximately 17 and 15 percent respectively in 2020. The primary reason for these projections is the implementation of efficiency measures and programs for both consumers and producers. While increasing spending on efficiency and renewable energy is expected to increase employment, many of the resulting jobs will not appear in the utility sector.

The retail trade sector, which is projected to grow by nearly 50 percent in both the business-as-usual and the Scoping Plan case, is also projected to experience a slight net decline in output relative to business-as-usual. Since gasoline is considered a consumer retail purchase under this model, the reduced growth is mostly due to the decrease of approximately $19 billion in retail transportation fuel purchases, which is largely offset by the positive $14 billion increase in spending at other retail enterprises.

Table 26: Summary of Economic Output by Sector from Modeling the Scoping Plan Using E-DRAM

Sector	Output ($Billions)			
	2007	Business-as-Usual	Scoping Plan	Percent Change from BAU
Agriculture, Forestry and Fishing	76	109	113	3.9%
Mining	27	29	31	7.2%
Utilities	51	72	60	-16.7%
Construction	114	164	166	1.7%
Manufacturing	673	943	948	0.5%
Wholesale Trade	120	171	173	1.0%
Retail Trade	207	296	291	-1.6%
Transportation and Warehousing	76	109	111	1.9%
Information	164	235	238	1.1%
Finance, Insurance and Real Estate	391	559	572	2.3%
Services	636	910	927	1.9%
Government	-	-	-	-
Total	**2,535**	**3,597**	**3,630**	**0.8%**

Table 27: Summary of Employment Changes by Sector from Modeling the Scoping Plan Using E-DRAM

Sector	Employment (thousands)			
	2007	Business-as-Usual	Scoping Plan	Percent Change from BAU
Agriculture, Forestry and Fishing	398	449	464	3.5%
Mining	26	26	26	1.3%
Utilities	60	67	57	-14.7%
Construction	825	929	934	0.5%
Manufacturing	1,821	2,046	2,057	0.5%
Wholesale Trade	703	791	793	0.1%
Retail Trade	1,688	1,901	1,916	0.8%
Transportation and Warehousing	447	503	510	1.2%
Information	398	448	450	0.4%
Finance, Insurance and Real Estate	911	1,026	1,046	2.0%
Services	5,975	6,729	6,773	0.7%
Government	3,100	3,491	3,502	0.3%
Total	**16,352**	**18,405**	**18,528**	**0.6%**

3. Household Impacts

Implementation of the Scoping Plan will provide low- and middle-income households savings on the order of a few hundred dollars per year in 2020 compared to the business-as-usual case, primarily as a result of increased energy efficiencies.

Low-Income Households: Based on current U.S. Department of Health and Human Services poverty guidelines, we evaluated the projected impacts of the plan on households with earnings at or below both 100 and 200 percent of the poverty guidelines. For all households, including those with incomes at 100 percent and 200 percent of the poverty level, implementation of the Scoping Plan produces a slight increase in per-capita income relative to the business-as-usual case.

At the same time, the analysis projects an increase of approximately 50,000 jobs available for lower-income workers[49] relative to business-as-usual as a result of implementing the Plan. The largest employment gains come in the retail, food service, agriculture, and health care fields. A decline in such jobs is projected in the retail gasoline sector due to the overall projected decrease in output from this sector. This decline, however, is more than offset by the increases experienced in other areas.

Another important factor to consider when analyzing the impact of the Scoping Plan on households is how it will affect household expenditures. As indicated in Table 28, analysis based on the modeling projections estimates a savings (i.e., reduced expenditures) of around $400 per household in 2020 for low-income households under both federal poverty guideline definitions. These savings are driven primarily by the implementation of the clean car standards and energy efficiency measures in the Scoping Plan that over time are projected to outweigh potential increases in electricity and natural gas prices that may occur. As the measures in the Scoping Plan are implemented, ARB will work to ensure that the program is structured so that low income households can fully participate in and benefit from the full range of energy efficiency measures. Many of California's energy efficiency efforts are targeted specifically at low income populations, and the CPUC's Long Term Strategic Plan for energy efficiency has redoubled its objective for the delivery of energy efficiency measures to low income populations. Additional information regarding the data in Table 28 can be found in Appendix G.

[49] Low-income jobs are defined as those with a median hourly wage below $15 per hour (2007 dollars) based on wage data and staffing pattern projections from the California Employment Development Department. The shares of low-wage occupations for each industry are then applied to the corresponding E-DRAM sector employment projections.

Table 28: Impact of Implementation of the Scoping Plan on Total Estimated Household Savings in 2020 (2007 $)

Income at 100% of Poverty Guideline	Income at 200% of Poverty Guideline	Middle Income*	High Income**	All Households***
$400	$400	$500	$500	$500

* All households between 200% and 400% of the poverty guidelines.

** All households above 400% of the poverty guidelines.

*** Average of households of all income levels.

The analysis indicates that implementation of the Scoping Plan is likely to result in small savings for most Californians, with little difference across income levels. Largely due to increased efficiencies, low-income households are projected to be slightly better off from an economic perspective in 2020 as a result of implementing AB 32.

Middle-Income Households: Implementation of the plan produces a small increase in household income across all income levels, including middle-income households, relative to the business-as-usual case.[50] In terms of how jobs for middle-income households[51] would be impacted, the modeling indicates a slight overall increase of almost 40,000 in 2020.

As shown in Table 28, the analysis projects a net-savings in annual household expenditures of about $500 in 2020 for middle-income households. These savings are driven by the emergence of greater energy efficiencies that will be implemented as a result of the plan.

4. WCI Economic Analysis

The Scoping Plan recommends that California develop a cap-and-trade program that links to the broader regional market being developed by the Western Climate Initiative (WCI). In order to examine the economic impacts of WCI program design options, WCI Partner jurisdictions contracted with ICF International and Systematic Solutions, Inc. (SSI) to perform economic analyses using ENERGY 2020, a multi-region, multi-sector energy model. The WCI economic modeling results are reported in full in Appendix D and are discussed in the Background Report on the Design Recommendations for the WCI Regional Cap-and-Trade Program, also included in Appendix D.

To help inform the program design process, the WCI analysis examined the implications of key design decisions, including: program scope, allowance banking,

[50] For purposes of our analysis we define "middle-income" households as those earning between 200% and 400% of the federal poverty guidelines.

[51] Hourly wage between $15 and $30 per hour.

and the use of offsets. Due to time and resource constraints, the modeling was limited to the eight WCI Partner jurisdictions in the Western Electric Coordinating Council (WECC) area, thereby excluding from the analysis three Canadian provinces, Manitoba, Quebec, and Ontario. Future analyses are planned that will integrate these provinces so that a full assessment of the WCI Partner jurisdictions can be performed.

The WCI modeling work is not directly comparable to the ARB results reported here. The WCI analysis relies on a more aggregated set of greenhouse gas emissions reduction measures rather than the specific individual policies recommended in the Scoping Plan; it uses somewhat different assumptions regarding what measures are included in the "business-as-usual" case, and it models the entire WECC rather than California. Nevertheless, the results of the WCI modeling provide useful insight into the economic impact of greenhouse gas emissions reduction policies.

Consistent with the conclusions of the ARB evaluation, overall the WCI analysis found that the WCI Partner jurisdictions can meet the regional goal of reducing emissions to 15 percent below 2005 levels by 2020 (equivalent to the AB 32 2020 target) with small overall savings due to reduced energy expenditures exceeding the direct costs of greenhouse gas emissions reductions. The savings are focused primarily in the residential and commercial sectors, where energy efficiency programs and vehicle standards are expected to have their most significant impacts. Energy-intensive industrial sectors are estimated to have small net costs overall (less than 0.5 percent of output).

The WCI analysis does not examine the potential macroeconomic impacts of the costs and savings estimated with ENERGY 2020. The WCI Partner jurisdictions are planning to continue the analysis so that macroeconomic impacts, such as income, employment, and output, can be assessed. Once completed, the macroeconomic impacts can be compared to previous studies of cap-and-trade programs considered in the United States and Canada.

B. Green Technology

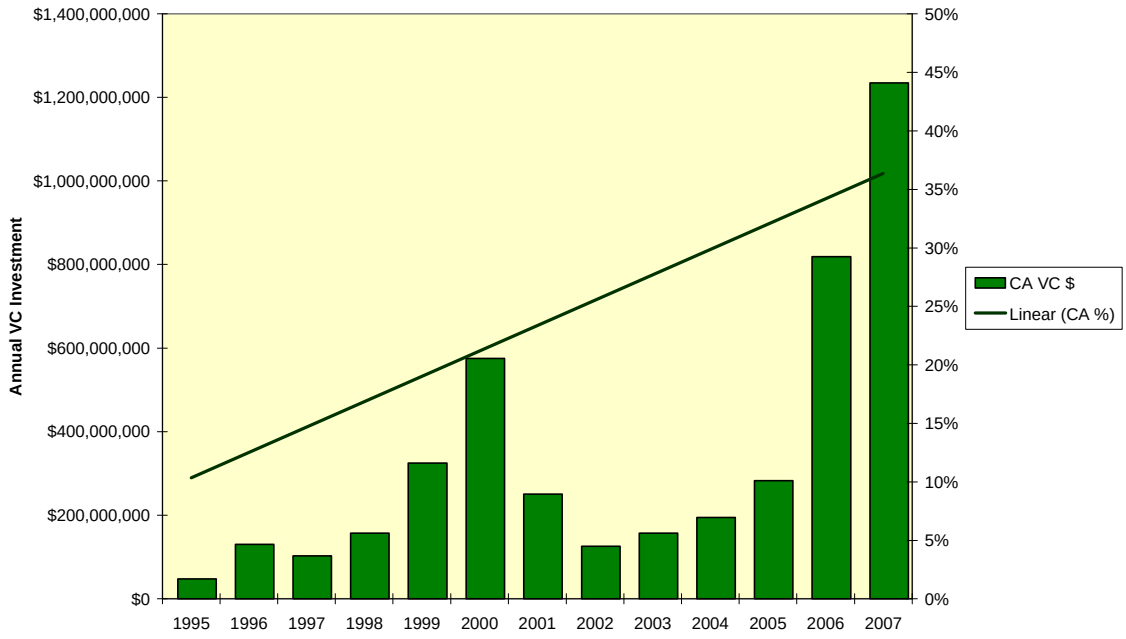
The development of green technologies and a trained workforce equipped to design, develop and deploy them will be key to the success of California's long-term efforts to combat global warming. Bold, long-range environmental policies help drive innovation and investment in emission-reducing products and services in part by attracting private capital. Typically, the private sector under invests in research and development for products that yield public benefits. However, when environmental policy is properly designed and sufficiently robust to support a market for such products, private capital is attracted to green technology development as it is to any strategic growth opportunity.

California's leadership in environmental and energy efficiency policy has helped attract an increasing share of venture capital investment in green technologies. According to statistics from PricewaterhouseCoopers and the National Venture Capital Association, California's share of U.S. venture capital investment in innovative energy technologies increased

dramatically from 1995 to 2007 (see Figure 5 below).[52] The same period saw a stream of pioneering environmental policy initiatives, including energy efficiency codes for buildings and appliances, a renewables portfolio standard for electricity generation, climate change emissions standards for light-duty automobiles and, most recently, AB 32. Flows of venture capital into California are escalating as a direct result of the focus on reductions of greenhouse gas emissions. As mentioned above, California captured the largest single portion of global venture capital investment ($800 million out a total of two billion dollars) during the second quarter of 2008.

Figure 5

California's Growing Share of Venture Capital Investment in Energy Innovation, 1995-2007 (current $, % share)



Source: PricewaterhouseCoopers MoneyTree Report, available at: [https://www.pwcmoneytree.com].

A survey of clean technology investors by Global Insight and the National Venture Capital Association found that public policy influences where venture capitalists invest.[53] Furthermore, investments in green technology solutions produce jobs at a higher rate than investments in comparable conventional technologies.[54] Venture capitalists estimate that

[52] Based on historical trend data for the 'Industrial/Energy' industry for California and the United States from the PricewaterhouseCoopers MoneyTree Report. https://www.pwcmoneytree.com/MTPublic/ns/nav.jsp?page=historical (accessed October 12, 2008)

[53] Clean Tech Entrepreneurs & Cleantech Venture Network LLC. *Creating Cleantech Clusters: 2006 Update*. May 2006. p.43 http://www.e2.org/ext/doc/2006%20National%20Cleantech%20FORMATTED%20FINAL.pdf (accessed October 12, 2008)

[54] Report of the Renewable and Appropriate Energy Laboratory. *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?* Energy and Resources Group/Goldman School of Public Policy at

each $100 million in venture capital funding, over a period of two decades, helps create 2,700 jobs, $500 million in annual revenues, and many indirect jobs.[55]

Access to capital controlled by institutional investors is also enhanced by policies that encourage early adoption of green technologies. When California-based corporations use green technologies to reduce their exposure to climate change risk, institutional investors reward them by facilitating their access to capital. The Investor Network on Climate Risk – including institutional investors with more than $8 trillion of assets under management – endorsed an action plan in 2008 that calls for requiring asset managers to consider climate risks and opportunities when investing; investing in companies developing and deploying clean technologies; and expanding climate risk scrutiny by investors and analysts.[56]

Additional capital for green technologies helps drive increased employment, both indirectly, as energy savings are plowed back into other sectors of the economy, and directly, as new green products are successfully commercialized.

McKinsey & Company projects average annual returns of 17 percent on global investments in energy productivity, and estimates the global investment opportunity at $170 billion annually through 2020.[57] Meanwhile, global investment in energy efficiency and renewable energy has grown from $33 billion to more than $148 billion in the last four years. Beyond 2020, green technologies are expected to attract investment of more than $600 billion annually.[58] In short, green technology is now a *bona fide* global growth industry.

Today, green technology businesses directly employ at least 43,000 Californians, primarily in energy efficiency and energy generation, according to a 2008 study from the California Economic Strategy Panel. Green jobs are concentrated in manufacturing (41 percent), and professional, scientific and technical services (28 percent), with median annual earnings of

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University of California, Berkeley. April 13, 2004. http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf (accessed October 12, 2008)

[55] Report prepared for the National Venture Capital Association. *Venture Impact 2004: Venture Capital Benefits to the U.S. Economy*. Prepared by: Global Insight. June 2004. http://www.globalinsight.com/publicDownload/genericContent/07-20-04_fullstudy.pdf (accessed October 12, 2008)

[56] The Investor Network on Climate Risk. *Final Report, 2008 Investor Summit on Climate Risk*. February 14, 2008. http://www.ceres.org//Document.Doc?id=331 (accessed October 12, 2008)

[57] McKinsey Global Institute. *The Case for Investing in Energy Productivity*. McKinsey & Company. February, 2008. p.8 http://www.mckinsey.com/mgi/reports/pdfs/Investing_Energy_Productivity/Investing_Energy_Productivity.pdf (accessed October 12, 2008)

[58] United Nations Environment Programme-New Energy Finance Ltd. *Global Trends in Sustainable Energy Investment 2008: Analysis of Trends and Issues in the Financing of Renewable Energy and Energy Efficiency* 2008. p.12 ISBN: 978-92-807-2939-9 http://www.unep.fr/energy/act/fin/sefi/Global_Trends_2008.pdf (accessed October 12, 2008)

$35,725 and $56,754, respectively.[59] By 2030, under a moderate growth scenario, green businesses nationwide are expected to generate revenues of $2.4 trillion, (2006 dollars), and employ 21 million Americans.[60]

As a leader in green technology development and use, California has already realized substantial economic benefits from the adoption of energy efficiency policies. State energy efficiency measures have saved enough energy over the past 30 years to avoid construction of two dozen 500-megawatt power plants. Today, California's per capita electricity consumption is 40 percent below the national average, and the carbon intensity of California's economy is among the lowest in the nation.[61]

Renewable energy, such as solar, wind, biomass, geothermal, will also bring new employment opportunities to Californians while spurring economic growth. California enjoys significant comparative advantages for renewable energy: concentrated innovation resources, a large potential customer base, key natural resources such as reliable solar and wind, and supportive regulatory programs, including the California Renewables Portfolio Standard, the Million Solar Roofs Initiative, the California Global Warming Solutions Act of 2006, and the Solar Water Heating and Efficiency Act of 2007.

Other researchers have estimated that under a national scenario with 15 percent renewables penetration by 2020, California will experience a net gain in direct employment of 140,000 jobs.[62] Because investments in green technologies produce jobs at a higher rate than investments in conventional technologies, jobs losses that occur in traditional fossil fuel industries will be more than compensated for by gains in the clean energy sector.

Furthermore, if California's renewable energy suppliers field products that are sufficiently competitive to penetrate the export market, employment and earnings dividends for the state will also increase. California renewable energy industries servicing the export market can generate up to 16 times more employment than those that only manufacture for domestic

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[59] California Economic Strategy Panel with Collaborative Economics. *Clean Technology and the Green Economy*. March 2008. P.14-15 http://www.labor.ca.gov/panel/pdf/DRAFT_Green_Economy_031708.pdf (accessed October 12, 2008)

[60] The American Solar Energy Society. *Renewable Energy and Energy Efficiency: Economic Drivers for the 21st Century*. 2007. p.39 ISBN 978-0-89553-307-3 http://www.ases.org/images/stories/ASES-JobsReport-Final.pdf (accessed October 12, 2008)

[61] California Energy Commission. *2007 Integrated Energy Policy Report*. Document No. CEC-100-2007-008-CMF. 2007. p. 3 http://www.energy.ca.gov/2007publications/CEC-100-2007-008/CEC-100-2007-008-CMF.PDF (accessed October 12, 2008)

[62] Tellus Institute and MRG Associates. *Clean Energy: Jobs for America's Future.* As cited in: Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate? Energy and Resources Group/Goldman School of Public Policy at University of California, Berkeley. April 13, 2004. http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf (accessed October 12, 2008)

consumption, according to a study by the Research and Policy Center of Environment California.[63]

C. Cost-Effectiveness

As noted in several provisions of AB 32, cost-effectiveness is an important requirement to be considered in the design and implementation of emission reduction strategies. (See HSC §§38505, 38560, 38561, 38562.) AB 32 defines "cost-effective" or "cost-effectiveness" as "the cost per unit of reduced emissions of greenhouse gases adjusted for its global warming potential." (HSC §38505(d)) This definition specifies the metric (i.e., dollars per ton) by which the Board must express cost-effectiveness, but it does not provide criteria to assess if a regulation is or is not cost-effective. It also does not specify whether there should be a specific upper-bound dollar per ton cost that can be considered cost-effective, or how such a bound would be determined or adjusted over time. ARB has investigated different approaches that could be used to evaluate the cost-effectiveness of regulations and is recommending the following approach.

The estimated cost per ton of greenhouse gas emissions reduced by the measures recommended in this Plan ranges from $-408 (net savings) to $133, with all but one (the Renewables Portfolio Standard) costing less than $55 per ton. The RPS is being implemented for energy diversity purposes, not just greenhouse gas reductions, and the $133 per ton figure does not take these other benefits into account. Therefore, it should not be used as a reference to define the range of cost-effective greenhouse gas measures. These estimates are based on the best information available as ARB prepared this Plan. Updated estimates and greater certainty will be provided as the measures are further developed during the rulemaking process.

In the meantime, the current estimates provide a range illustrating the cost per ton of the mix of measures that collectively meet the 2020 target. This range will assist the Board in evaluating the cost-effectiveness of individual measures when considering adoption of regulations. The range of acceptable cost-effectiveness may change if effective lower-cost measures and options are identified. Because both the projections of "business-as-usual" 2020 emissions and the degree of reductions from any given measures may be greater or less than current estimates, the determination should remain flexible to accommodate a higher or lower estimate of cost-effectiveness. In addition, the approach must provide flexibility to pursue measures that simultaneously achieve policy objectives other than greenhouse gas emissions reduction (such as energy diversity).

The criteria for judging cost-effectiveness will be updated as additional technological data and strategies become available. As ARB moves from adoption of the Scoping Plan to

[63] Environment California Research and Policy Center. *Renewable Energy and Jobs. Employment Impacts of Developing Markets for Renewables in California*. July 2003. As cited in: Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate? Energy and Resources Group/Goldman School of Public Policy at University of California, Berkeley. April 13, 2004. http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf (accessed October 12, 2008)

developing specific regulations, and as regulations continue to be adopted, updated cost-effectiveness estimates will be established in a rigorous and transparent process with full stakeholder participation. As ARB progresses from proposed measures and estimated costs to actual regulations, the comparison of cost-effectiveness would move toward the well established practice of comparing the cost-effectiveness of new regulations to the cost-effectiveness of previously enacted and/or similar regulations. This approach is consistent with how cost-effectiveness is evaluated for strategies to reduce criteria and toxic pollutants.

D. Small Business Impact

Small businesses play an important role in California's economy. As required under AB 32, ARB analyzed the impact that implementation of the Scoping Plan would have on small businesses in the state. The analysis indicates that the primary impacts on small businesses as a result of AB 32 will come in the form of changes in the costs of goods and services that they procure, and in particular, changes in energy expenditures. Due to the number of measures in the plan that will deliver significantly greater energy efficiencies, our analysis projects that implementation of the plan will have a positive impact on small business in California even after taking into account the higher per-unit energy prices that are likely to occur between now and 2020. Small businesses also will benefit as a result of the robust economic growth and the increases in jobs, production, and personal income that are projected between now and 2020 as AB 32 is implemented. Additional information is provided in Appendix G.

Recent analysis from Energy and Environmental Economics, Inc. (E3) forecasts that a package of greenhouse gas emissions reduction measures similar to those recommended in this Plan would deliver a five percent decrease in electricity expenditures for the average California electricity customer relative to business-as-usual in 2020.[64] This projection is based on the assumption that increases in electricity prices will be more than offset by the continued expansion of energy efficiency measures and that more efficient technologies will be developed and implemented.[65] For purpose of this analysis, expenditures on natural gas are assumed to remain the same, balancing the projected 29 percent decrease in natural gas consumption in California with the model's projected natural gas price increase of almost 9 percent.

Based on this assessment, implementation of the Scoping Plan will likely have minor but positive impacts on small businesses in the state. These benefits are attributable primarily to the measures in the plan that will deliver significantly greater energy and fuel efficiencies. Even when higher per unit energy prices are taken into account, these efficiencies will decrease overall energy expenditures for small businesses. Additionally, as previously described, the California economy is projected to experience robust economic growth

[64] Based on their GHG Calculator, CPUC/CEC GHG Docket (CPUC Rulemaking.06.04.009, CEC Docket 07-OIIP-01), available at http://www.ethree.com/cpuc_ghg_model.html.

[65] The E3 analysis focuses on direct programmatic measures and does not include the incremental price impact of the cap-and-trade program, which will depend upon allowance price, allocation strategy, the capped sector industry response, and other program design decisions.

between now and 2020 as AB 32 is implemented. Small businesses will experience many of the benefits associated with this growth in the form of more jobs, greater production activity, and rising personal income.

The projected decrease in electricity expenditures is especially important for small businesses since they typically spend more on energy as a percentage of revenue compared to larger enterprises. For example, firms with a single employee spend approximately 3.3 percent of each sales dollar on electricity, while businesses with between ten and forty-nine employees spend around 1.2 percent. As a result, smaller businesses are likely to experience a greater relative benefit from decreased energy expenditures relative to their larger counterparts.

From the broader economic perspective, these changes will make California more competitive as a location for small business, moving it from 7th highest to 19th among all states in terms of the percentage of revenue that businesses expend on electricity.[66] As was noted above for low income households, care must be taken to ensure that the program is structured to allow small businesses to participate in and benefit from the energy efficiency measures.

While ARB's analysis indicates a positive impact on small businesses from AB 32 implementation, to ensure that these benefits are realized to the fullest potential it will take additional outreach and communication efforts on the part of ARB and many other state and local entities. There are a number of existing programs that are designed to help small businesses achieve greater efficiencies in energy use. These programs can be enhanced and expanded upon, and new programs and efforts can be developed to ensure that all small businesses in California are aware of and able to take cost-effective steps to reduce energy use and enjoy the associated economic savings. For example, as discussed more completely in Chapter IV, ARB and our partners in State government are working together to develop an on-line small business "toolkit" designed for small and medium-sized businesses to provide a one-stop shop of technical and financial information resources. As further development and implementation of the measures in the plan proceeds, we will work with other state and local partners to ensure that small businesses can both benefit from and play a role in helping to achieve our greenhouse gas emission reduction requirements.

E. Public Health/Environmental Benefits Analyses

AB 32 requires ARB to evaluate the environmental and public health impacts of the Scoping Plan. The analysis of this plan is focused primarily on the quantification of public health benefits from air quality improvements that would result from implementation. Unlike traditional pollutants and toxic emissions, global warming pollutants do not typically have localized impacts. At ambient levels, carbon dioxide, which makes up over 80 percent of global warming pollutants in California, has no direct environmental or public health consequences. Climate change caused by greenhouse gas pollutants emitted in another state

[66] Although the natural gas data is less specific, a similar scenario is expected where increased prices are typically offset by greater efficiencies for most small businesses.

or country has the same potential to damage our public health and the environment as does climate change due to pollutants emitted within California. Although this analysis does not consider the public health impacts of climate change, the potential public health impacts are great, and have been well documented elsewhere. However, many of the measures aimed at reducing global warming pollutants also provide co-benefits to public health and California's natural resources.

The environmental and cumulative impacts of the Plan are discussed in the California Environmental Quality Act (CEQA) document that is included in Appendix J. As the Scoping Plan is implemented, and specific measures are developed, ARB will conduct further CEQA analyses, including cumulative and multi-media impacts. As ARB further develops its approach for consideration of these issues in future rulemakings, and updates needed analytical tools and data sets, we will consult with outside experts and the EJAC. ARB recognizes that the adoption of the Scoping Plan will launch a variety of regulatory proceedings in many different venues. ARB will work closely with other California State agencies including: the Office of Planning and Research, Environmental Protection Agency, Resources Agency, Integrated Waste Management Board, Department of Public Health, Office of Environmental Health Hazard Assessment, State Water Resources Control Board, Department of Toxic Substances Control, Department of Water Resources, Board of Forestry, Department of Fish and Game, Public Utilities Commission, California Energy Commission, and others to identify and address potential multi-media environmental impacts early in the regulatory development process.

California's actions to reduce greenhouse gas emissions will help transition the State to new technologies, improved efficiencies, and land use patterns also necessary to meet air quality standards and other public health goals. California's challenging public health issues associated with air pollution are already the focus of comprehensive regulatory and incentive programs. These programs are reducing smog forming pollutants and toxic diesel particulate matter at a rapid pace. However, to meet increasingly stringent air quality standards and air toxics reduction goals, transformative changes are needed in the 2020 timeframe and beyond. Implementation of AB 32 will provide additional support to existing State efforts devoted to protecting and improving public health.

1. Key Air Quality-Related Public Health Benefits

The primary direct public health benefits of the Scoping Plan are reductions in smog forming emissions and toxic diesel particulate matter. The most significant reductions are of oxides of nitrogen (NOx), which forms both ozone and particulate pollution (PM2.5), and directly emitted PM2.5, which includes diesel particulate matter. The analysis focuses on PM2.5 impacts and quantifies 2020 public health benefits of this plan in terms of avoided premature deaths, hospitalizations, respiratory effects, and lost work days. Additional benefits associated with the reductions in ozone forming emissions were not quantified since statewide 2020 photochemical modeling is not available.

The estimated air quality-related public health benefits of the Scoping Plan are above and beyond the much greater benefits of California's existing programs, which are reducing air pollutant emissions every year. This continuing progress is the result of California's plans for meeting air quality standards ("State Implementation Plans" or SIPs), reducing emissions from goods movement activities, and addressing health risk from diesel particulate matter. These programs address both existing and new sources of air pollution, taking into account population and economic growth. The additional benefits of the Scoping Plan in 2020 are significant, and in the longer term, can be expected to increase with further reductions in fossil fuel combustion, the primary basis for the estimated public health benefits.

The recommended measures in the Scoping Plan that reduce smog forming ("criteria") pollutants are shown in Table 29 along with the estimated reductions. Statewide, these measures would reduce approximately 61 tons per day of NOx and 15 tons per day of PM2.5 in 2020. As shown in Table 30, this equates to an estimated air quality-related public health benefit of 780 avoided premature deaths statewide. In comparison, reductions in PM2.5 from California's existing programs and 2007 SIP measures are estimated to result in 12,000 avoided premature deaths statewide in the same timeframe.

Table 29: Statewide Criteria Pollutant Emission Reductions in 2020 from Proposed Scoping Plan Recommendation[67]

(tons per day)

Measure	NOx	PM2.5
Light-Duty Vehicle • Pavley I and Pavley II GHG Standards • Vehicle Efficiency Measures	1.6	1.4
Goods Movement Efficiency Measures	16.9	0.6
Medium and Heavy-Duty Vehicle GHG Emission Reduction • Aerodynamic Efficiency • Hybridization • Engine Efficiency	5.6	0.2
Local Government Actions and Regional Targets	8.7	1.4
Energy Efficiency and Conservation (Electricity)	7.0	4.0
Energy Efficiency and Conservation (Natural Gas)	10.4	0.8
Solar Water Heating	0.3	0.03
Million Solar Roofs	1.0	0.6
Renewables Portfolio Standard	9.8	5.6
Total	**61**	**15**

[67] Table 29 does not include the criteria pollutant co-benefits of additional greenhouse gas reductions that would be achieved from the proposed cap-and-trade regulation because we cannot predict in which sectors they would be achieved.

Table 30: Estimates of Statewide Air Quality-Related Health Benefits in 2020

Health Endpoint	Health Benefits of Existing Measures and 2007 SIP *mean*	Health Benefits of Recommendations in the Proposed Scoping Plan *mean*
Avoided Premature Death	12,000	780
Avoided Hospital Admissions for Respiratory Causes	1,300	87
Avoided Hospital Admissions for Cardiovascular Causes	2,600	170
Avoided Asthma and Lower Respiratory Symptoms	190,000	12,000
Avoided Acute Bronchitis	15,000	980
Avoided Work Loss Days	1,200,000	77,000
Avoided Minor Restricted Activity Days	7,000,000	450,000

In addition to the quantified air-quality-related health benefits, our analysis indicates that implementation of the Scoping Plan can deliver other public health benefits as well. These include potential health benefits associated with local and regional transportation-related greenhouse gas targets that can facilitate greater use of alternative modes of transportation, such as walking and bicycling. These types of moderate physical activities reduce many serious health risks including coronary heart disease, diabetes, hypertension and obesity.[68] Finally, it is important to note that the steps California is taking to address global warming, along with actions by other regions, states, and nations, will help mitigate the public health effects of heat waves, more widespread incidence of illness and disease, and other potentially severe impacts.

The measures in the Scoping Plan are designed primarily to help spur the transition to a lower carbon economy. However, in addition to improving air quality, these measures can also improve California's environmental resources, including land, water, and native species. Land resources will be affected by regional transportation-related targets leading to improved land use planning, and forest carbon sequestration targets which can result in better stewardship of California lands and reduced wildfire risk. A number of conservation measures will aid in effective management of the State's precious water resources. Demand for waste disposal and hazardous materials should decrease as measures to encourage recycling and reuse transform our wastes into fuel, energy, and other useful products are implemented. Additional analysis of the way that implementation of the Scoping Plan will impact these environmental resources will be conducted as we proceed. Many of these measures serve the dual purpose of mitigating greenhouse gas emissions and helping California adapt to the impacts of climate change.

[68] Appendix H contains a reference list of studies documenting the public health benefits of alternative transportation.

2. Approach

ARB quantified the potential reductions of NOx and PM2.5 from implementation of the Plan's recommendations, and the public health benefits associated with the resulting potential air quality improvement. These analyses compare NOx and PM2.5 emissions in 2020 with the implementation of the Scoping Plan with NOx and PM2.5 emissions in 2020 in the absence of the Scoping Plan – a "business-as-usual" scenario. The methodology used to evaluate the public health benefits of the emission reductions is similar to the methodology used in ARB's 2006 Goods Movement Emission Reduction Plan (GMERP), as updated in the recent staff report for estimating premature death from exposure to particulate matter.[69] This methodology is based on a peer-reviewed methodology developed by the U.S. Environmental Protection Agency (U.S. EPA). ARB augmented U.S. EPA's methodology by incorporating the result of new epidemiological studies relevant to California's population, including regionally specific studies, as they became available.

AB 32 directs ARB to conduct several levels of analysis as we proceed through the development and implementation of a comprehensive greenhouse gas emissions reduction strategy. As part of the Scoping Plan development, ARB is required to assess both the economic and non-economic impacts of the plan as noted above. Additionally, AB 32 requires ARB to undertake additional analysis at the time of adoption of regulations, including market-based compliance mechanisms.

Although not yet at the stage of regulatory development and adoption, in this analysis ARB conducted an evaluation of the air quality-related public health benefits associated with the Scoping Plan based on a community level emissions analysis example. As regulations that rely on market-based compliance mechanisms are further developed for consideration by the Board, more detail about the specific regulatory proposals will be developed, enabling ARB to more closely evaluate the potential for direct, indirect and cumulative impacts.

3. Existing Programs for Air Quality Improvement in California

The public health analysis of the Scoping Plan presents air-quality benefits that will occur in addition to the benefits of California's comprehensive air quality programs designed to meet health-based standards and reduce health risk from air toxics. It is also important to note that under both a "business-as-usual" scenario and under the implementation of the Scoping Plan, the population and economy of California are projected to continue to grow. New businesses and industries will continue to be sited in California, bringing both economic opportunity and potential environmental impacts. Federal, State, and local laws and regulations have established requirements to ensure that new and modified sources of pollution are carefully evaluated and that

[69] Air Resources Board. *Methodology for Estimating Premature Deaths Associated with Long-term Exposure to Fine Airborne Particulate Matter in California.* October 24, 2008. http://www.arb.ca.gov/research/health/pm-mort/pm-mort_final.pdf (accessed December 9, 2008)

significant impacts are mitigated. Emissions from existing businesses are also tightly controlled by local air pollution control districts. Statewide programs are in place to reduce emissions from cars, trucks, and off-road equipment, along with smog check, cleaner gasoline and diesel fuels, and regulations to reduce evaporative emissions from consumer products, paints, and refueling. Additional information about the existing regulatory framework for sources of air pollution is provided in Appendix H.

It is important to evaluate the air quality and public health benefits of the Scoping Plan in the context of the State's on-going air quality improvement efforts. California's long-standing air pollution control programs have substantially improved air quality in the state and will continue to do so in the future. By 2020, these programs will deliver reductions in statewide NOx emissions of 441 tons per day and direct fine particle emission reductions of 34 tons per day. Through 2020, three key ARB efforts will deliver deep reductions in air pollutant emissions despite continuing growth:

- Diesel Risk Reduction Plan
- Goods Movement Emission Reduction Plan
- 2007 State Implementation Plan

Measures in these plans will result in the accelerated phase-in of cleaner technology for virtually all of California's diesel engine fleets including trucks, buses, construction equipment, and cargo handling equipment at ports. Adoption and implementation of these and other measures are critical to achieving clean air and public health goals statewide.

The U.S. Environmental Protection Agency has set a new, more stringent, national ambient air quality standard for ozone that will have compliance deadlines well past 2020 for the most severely impacted areas like southern California.[70] The unmitigated impacts of climate change will make it harder to meet this standard and to provide healthful air to Californians.

4. Statewide Analysis

For this evaluation, ARB examined the recommended measures to determine the potential for impacts on air, land, water, native species and biological resources, and waste and hazardous materials. Local government, State government, and green building sectors were not included in this evaluation as they represent means of implementation of the greenhouse gas emission reduction measures. As noted, the main focus of this analysis is on air quality. To the extent feasible, ARB quantified estimated emissions reductions in criteria pollutants associated with each recommended measure except cap-and-trade. Reductions in NOx and PM2.5 were

[70] U.S. Environmental Protection Agency. *National Ambient Air Quality Standards for Ozone. Final Rule.* 73 Federal Register 16436. March 27, 2008. http://www.epa.gov/fedrgstr/EPA-AIR/2008/March/Day-27/a5645.pdf (accessed October 12, 2008)

used to estimate public health benefits. The estimated statewide reductions are 61 tons per day of NOx and 15 tons per day of PM2.5. Further analysis of the potential criteria pollutant benefits of a cap-and-trade program will be done as part of regulatory development.

5. Regional Assessment: South Coast Air Basin Example

In order to assess potential air quality benefits of the Scoping Plan on a regional level, ARB evaluated associated criteria pollutant reductions in the South Coast Air Basin as an example case. Existing programs will reduce current NOx emissions by almost 50 percent in 2020. With the new 2007 SIP measures, NOx emissions will be reduced almost 60 percent. Because of the large population and high pollutant concentrations in this region, greater benefits occur from each ton of pollution reduced. The estimated air quality-related public health benefits of the Scoping Plan for the South Coast region are shown in Table 31. The significant air quality-related public health benefits in this region are largely attributed to the additional reductions in PM2.5.

Table 31: Estimated Air Quality-Related Health Benefits of Existing Program, 2007 SIP, and Scoping Plan in the South Coast Air Basin, 2020

Health Impacts / Scenario	Benefits from Existing Program	Additional Benefits from 2007 SIP	Additional Co-Benefits from Scoping Plan
Premature Deaths Avoided	4,800	2,000	360
Hospitalizations Avoided – Respiratory	550	230	40
Hospitalizations Avoided – Cardiovascular	1,100	440	77
Asthma & Lower Respiratory Symptoms Avoided	80,000	35,000	6,200
Acute Bronchitis Avoided	6,400	2,800	500
Work Loss Days Avoided	510,000	220,000	38,000
Minor Restricted Activity Days Avoided	3,000,000	1,300,000	220,000

6. Community Level Assessment: Wilmington Example

ARB also conducted an evaluation of the potential air quality impacts of the Scoping Plan in the community of Wilmington as an illustration of the potential for localized impacts. Wilmington is in southern Los Angeles County and includes a diverse range of stationary and mobile emissions sources, including the ports of Los Angeles and Long Beach, railyards, major transportation corridors, refineries, power plants, and other industrial and commercial operations. Like the regional analysis, additional emission reductions from the 2007 SIP were estimated and show significant reductions in Wilmington by 2020 – approximately a 45 percent reduction in NOx and a 40 percent reduction in directly-emitted PM2.5. Mobile source emissions are projected to continue to be proportionately greater than stationary source emissions in 2020 even as mobile source emissions decline.

For this assessment, ARB evaluated criteria pollutant emission reductions in the Wilmington study area assuming that the source-specific quantified measures are implemented, including measures to reduce emissions from oil and gas extraction and refineries. It was further assumed that the non-source specific program elements, such as the proposed cap-and-trade program, result in a 10 percent reduction in fuel combustion by affected sources within the study area. For example, it is estimated that industrial sources would achieve greenhouse gas emission reductions through efficiency measures that reduce on site fuel use by 10 percent either in response to a cap-and-trade program, or due to the results of the facility energy efficiency audits. While it is likely that the actual onsite reductions will differ across individual facilities from the assumed uniform ten percent reduction,[71] the analysis identifies how reductions at these facilities affect the overall level of co-benefits.

The estimated NOx co-benefit of about 1.7 tons per day is small relative to the projected reductions of 24 tons per day that will occur as a result of the SIP and other measures. For example, an 8 ton per day NOx reduction is expected from cleaner port trucks. In comparison, the potential NOx benefit from a 10 percent efficiency improvement in major goods movement categories is estimated at about 1.5 tons per day. The estimated PM2.5 co-benefits, on the order of 0.12 tons per day, are also small relative to the projected reductions of 2.3 tons per day that will occur as a result of the SIP and other measures. Approximately 30 percent (0.04 ton per day) of the PM 2.5 co-benefit reduction is associated with assumed energy efficiency measures at the four large refineries in the study area, while another 30 percent would occur due to a 10 percent efficiency improvement by goods movement sources.

The co-benefit emissions reductions in the study area would produce regional air quality-related health benefits. A relatively small portion of these benefits would occur in the study area (approximately 300,000 area residents). Health benefits due to reductions in NOx are mostly at the regional levels, since NOx emissions have usually travelled some distance before they are transformed into PM via atmospheric reactions. Point source combustion PM emissions persist in the atmosphere and increase exposures both in the area where they are emitted and broadly throughout the region. Based on previous modeling studies of the impact of port and rail yard PM emissions in the South Coast Air Basin conducted by ARB, PM exposures will be reduced far beyond the study area, and a majority of the health benefits are expected to occur in areas outside of the Wilmington community.[72]

Using the previously described methodology that correlates emission reductions in the air basin with expected regional health benefits there would be an estimated

[71] The reductions at any one facility could be much greater or lesser than 10 percent For example, very small or no reductions might occur because available cost-effective industrial emission reductions have already been implemented at a particular site.

[72] ARB analysis indicates that about 20 percent of the health benefits would occur in the Wilmington area.

24 avoided premature deaths attributed to emission reductions that occur in Wilmington as a result of the Scoping Plan.[73]

F. Summary of Societal Benefits

AB 32 requires ARB to "consider the overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health" (HSC § 38562(b)(6)) when developing regulations to implement the Scoping Plan. ARB conducted an initial assessment of societal benefits associated with AB 32 implementation. This section summarizes those that have been identified during development of the Scoping Plan, including diversification of energy sources, mobility, regressivity, and job creation. More detailed economic and environment/public health analyses can be found in Appendix G and H, respectively. The impact of low income households (regressivity), impacts on small businesses, and impact on jobs are described in the Economic Analysis section and Appendix G.

1. Energy Diversification

Generally, energy-related measures in this Scoping Plan are expected to result in a transformation of the State's energy portfolio, driven primarily by the Low Carbon Fuel Standard (LCFS), which addresses transportation fuel, and the 33 percent RPS, which increases renewably-produced electricity production and distribution to households and businesses.

The LCFS aims to achieve at least a 10 percent reduction in the carbon intensity of California's transportation fuels by 2020. As the State moves toward less dependence upon one source of fuel for transportation, our economy will be less at risk from significant fluctuations in fuel prices. Measures within the Scoping Plan will force energy diversification in California toward low-carbon intensive energy sources and encourage significant growth in infrastructure, capital, and investment in biofuels.

The move toward 33 percent renewables will, by definition, increase the diversification of California's electrical supply. Increased use of wind, solar, geothermal and biomass (including from the organic fraction of municipal solid waste) generation will all add to ensuring the state has a broader portfolio of energy inputs.

Based on ARB's economic analysis, the combined energy diversification and increased energy efficiency expected from implementation of the Scoping Plan is predicted to result in: a 25 percent decrease in gasoline usage (4.6 billion gallons), a 17 percent decrease in diesel fuel use (670 million gallons), a 22 percent decrease in electricity (74,000 GWh reduction) and a 24 percent reduction in natural gas (3,400 therms).

[73] See Appendix H

The cap-and-trade program, offsets, and other measures that contain market-based features may also help diversify California's energy portfolio by incentivizing the development and deployment of clean and efficient energy generating technologies.

2. Mobility and Shifts in Land Use Patterns

Mobility is analyzed through multiple approaches in the Scoping Plan. Appendix C includes an analysis of a proposed measure for regional transportation-related greenhouse targets. Reductions in vehicle miles traveled (VMT) are expected to result from regional and local planning which target land use, building and zoning improvements.

As the Scoping Plan is implemented, measures that support shifts in land use patterns are expected to emphasize compact, low impact growth in urban areas over development in greenfields. Communities could realize benefits, such as improved access to transit, improved jobs-housing balance, preservation of open spaces and agricultural fields, and improved water quality due to decreased runoff. Local and regional strategies promoting appropriate land use patterns could encourage fewer miles traveled, lowering emissions of greenhouse gases, criteria pollutants and PM. More compact communities with improved transit service could increase mobility, allowing residents to easily access work, shopping, childcare, health care and recreational opportunities.

Furthermore, if open spaces and desirable locations become more accessible and communities are designed to encourage walkability between neighborhoods and shopping, entertainment, schools and other destinations, residents are likely to increase their levels of physical activity. Research shows that regular physical activity can reduce health risks, including coronary heart disease, diabetes, hypertension, anxiety and depression, and obesity. Measures in the Scoping Plan encourage Californians to use alternatives to personal vehicle travel that could result in increased personal exercise. To complement these changes, future community developments may evolve to include trails and pedestrian access to major centers. However, where compact development may increase proximity to large sources of pollution, such as high traffic arterials, distribution centers, and industrial facilities, it will be critical to analyze the anticipated and unanticipated impacts and benefits, to ensure that increases in exposure to vehicular air pollution and other toxics and particulates do not occur .

G. California Environmental Quality Act Functional Equivalent Document

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potential adverse environmental impacts of proposed projects. ARB's analysis of the potential adverse environmental impacts of the Scoping Plan is presented in Appendix J. The analysis summarizes and discusses the specific strategies in the Scoping Plan that, if adopted and implemented, will reduce greenhouse gas emissions throughout the state. The

evaluation is programmatic by necessity; it allows consideration of broad policy alternatives and program-wide mitigation measures at a time when an agency has greater flexibility to deal with basic problems of cumulative impacts. A programmatic document also plays an important role in establishing a structure within which future reviews of related actions can be effectively conducted. The Secretary of California's Resources Agency determined that ARB meets the criteria for a Certified Regulatory Program and requires ARB to prepare a substitute document. This functionally equivalent document (FED) is intended to disclose potential adverse impacts and identify mitigation measures specific to the actions identified in the Scoping Plan. The analysis generally found that the proposed Low Carbon Fuel Standard, Renewables Portfolio Standard and Water measures have the most potential to cause adverse environmental impacts due to the potential for land conversion when projects are undertaken. Additional environmental analysis will be needed when regulations are adopted and at the individual project level to identify mitigation for project specific impacts.

H. Administrative Burden

ARB conducted a assessment of the administrative burden of implementing the Scoping Plan recommendation. (HSC §38562 (b)(7)) The recommendation calls for ARB to develop a cap-and-trade program – a market-based regulatory program to cap and reduce emissions from the Industrial, Electricity, Natural Gas, and Transportation sectors. This program would require stringent monitoring and reporting on the part of the regulated community, and comprehensive enforcement on the part of ARB. Sources under the cap would need to analyze the best approach for their company to comply with a cap – assessing the cost of reducing emissions and comparing that to the cost of purchasing emission reductions in a market. Although ARB has not previously developed this type of market regulation, there is extensive experience to draw upon from within California, nationally, and internationally. In addition, the other regulatory components of the recommendation would require ARB and other State agencies to adopt a series of measures requiring regulatory development, outreach to stakeholders and the public, implementation by industry, and enforcement for numerous measures and programs.

I. De Minimis Emission Threshold

A minimum level at which regulations are determined not to apply is termed the 'de minimis threshold.' In recommending a de minimis level, ARB must take into account the relative contribution of each source or source category to statewide greenhouse gas emissions and the adverse effect on small business. (HSC §38561(e)) This threshold acts as a buffer below which the burden of regulation is determined to outweigh the potential harmful effect of the minimal level of emissions. However, it should not be assumed that an individual source of greenhouse gas emissions that is minimal if taken by itself will fall below the threshold. ARB often looks at the aggregate emissions from a source category or related source category when determining regulatory applicability.

A source category may be evaluated as the aggregate of businesses doing the same type of work (e.g., semiconductor manufacturers), a type of equipment (cargo handling equipment, cars), a process or product (cans of pressurized duster), or other aggregated sources of

emissions. Emissions of greenhouse gases from any individual entity within these source categories by themselves could be small. However, when emissions from the source category are evaluated, the relative contribution to climate change can be significant.

As ARB developed the Scoping Plan, potential measures were evaluated against criteria that included the relative contribution of the source to climate change. After this review and considering the level of emissions needed to meet the 1990 target established by AB 32, ARB recommends a de minimis level 0.1 $MMTCO_2E$ annual emissions per source category.[74] Source categories whose total aggregated emissions are below this level are not proposed for emission reduction requirements in the Scoping Plan but may contribute toward the target via other means.

ARB and other agencies implementing measures included in the Scoping Plan should carefully consider this de minimis level in developing regulations, and only regulate smaller source categories if there is a compelling necessity.

As each regulation to implement the Scoping Plan is developed, ARB and other agencies will consider more specific de minimis levels below which the regulatory requirements would not apply. These levels will consider the cost to comply, especially for small businesses, and other factors.

[74] The Forest sector was not included in determining the de minimis level because this sector serves both as a source and a sink for carbon, making the concept of a de minimis level less applicable.

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IV. IMPLEMENTATION: Putting the Plan into Action

Adoption of this Scoping Plan will be a groundbreaking step forward for California. However it is only the beginning of a journey that will last for decades, gradually moving the State into a low-carbon, clean energy future. Putting the Scoping Plan into action will be challenging but with adequate commitment and leadership from Californians up and down the state, it will be a success.

A. Personal Action

The greenhouse gas emission reductions required under AB 32 cannot be realized without the active participation of the people of California. While many of the measures in this Plan must be taken by large sources of emissions, such as power plants and industrial facilities, it is the voluntary commitment and involvement of millions of individuals and households throughout the State that will truly make this California's Plan.

Shifts in individual choices and attitudes drive changes in the economy and in institutions. This dynamic of changing individual behavior will influence California's effort to reduce greenhouse gas emissions. For example, as market forces and environmental awareness encourage more people to drive low-greenhouse gas emitting vehicles, the auto manufacturers will respond with more innovative models and more intensive research. Regulations requiring auto manufacturers to provide these cars will complement the market demand.

This means that thinking about climate change and our carbon footprint will naturally become part of how individuals make decisions about travel, work, and recreation. Some families may choose to purchase a more efficient vehicle when it comes time to replace their current model. Households may choose to lower their thermostat to 68 degrees Fahrenheit during the colder months, and raise it to 78 degrees when air conditioning is required. Some households may choose to swap out incandescent light bulbs for more efficient compact fluorescent lights. Others may choose to install solar water heaters, or arrays of solar electric panels on their roofs to take advantage of renewable energy, and lower their household energy bills. Many households may choose to plant trees to shade and cool their homes, and use landscaping and plants that require less water.

This Plan recommends measures that will help support many of these individual decisions to improve energy efficiency. Statewide measures and regional efforts will result in programs to promote public transportation or riding in carpools, subsidize the purchase of energy efficient appliances, or provide incentives to better insulate and weatherize older homes. ARB is fully committed to assuring California consumers have the widest possible choice of vehicles that emit fewer greenhouse gases than today's models, including the most advanced technology vehicles produced anywhere in the world.

Californians have embraced statewide programs that support positive change in home and business behavior. In less than two decades, separating household waste and recycling at home and work have become commonplace, as has the widespread purchase of appliances with the Energy Star label to save energy. Reducing our carbon footprint by moving toward a cleaner more efficient economy will produce a wide range of benefits to individuals, through lower energy bills and a healthier environment for all.

Conservation can also play a key role. By employing practices to use our resources more sparingly, consumers can both save money and reduce greenhouse gas emissions. On August 18, 2008, Governor Arnold Schwarzenegger launched the EcoDriving program – a comprehensive effort to save consumers money at the gas pump, reduce fuel use and cut CO_2 emissions. By following a set of easy-to-use best practices for driving and vehicle maintenance, a typical EcoDriver can improve mileage by approximately 15 percent. Furthermore, safety is improved when driving speeds are reduced, a key EcoDriving strategy.

Similarly, consumers and businesses can save money and reduce greenhouse gas emissions by conserving resources at homes, offices and commercial buildings. For example, wireless monitor devices to provide instantaneous energy-usage information inside the home are being developed to show users how many kilowatt hours they're consuming at any given moment – as well as how much it's costing them.[75] Providing real-time information on appliance energy use can greatly assist consumers in conserving electricity use.

Many Californians concerned about climate change have also begun to buy carbon offsets to mitigate the impact of their daily activities. These can take various forms, including options that allow consumers to add 'carbon credits' when buying airline tickets, or paying a small monthly charge on utility bills to buy green power. ARB will be working to establish clear rules for voluntary reductions and offsets that might be used for compliance with AB 32. These rules will also help establish clear guidelines for these types of voluntary carbon credit programs and provide California's businesses and consumers greater assurance that money spent on these programs result in real reductions in greenhouse gas emissions.

For more information about how to reduce one's personal carbon footprint, visit www.coolcalifornia.org. This web site provides a carbon footprint calculator and a "top ten" list of ways to save energy at home.

B. Public Outreach and Education

To be successful, a climate action program needs an effective public outreach and education program. The Plan calls for a robust statewide program designed to generate awareness and involvement in California's climate change efforts.

[75] The Sacramento Municipal Utility District (SMUD) is subsidizing PowerCost Monitors to 5,000 customers as a part of a demonstration program. [www.smud.org/residential/saving-energy/monitor.html]

The Climate Action Team will convene a steering team that includes State agencies and other public agencies such as the state's air districts, and public and private utilities, which have a strong track record of successful efforts at public education to reduce driving (Spare the Air) or promote energy efficiency and reduce energy demand. With the release of the California Energy Efficiency Strategic Plan, the CPUC has committed to the launch of a new brand for California Energy Efficiency in 2009, focused on energy efficiency opportunities and coordinated with climate change messaging under AB 32. The steering committee will develop a coordinated array of messages and draw upon a wide range of messengers to deliver them. These will include regional and local governments whose individual outreach campaigns can reinforce the broader State outreach themes while also delivering more targeted messages directly tied to specific local and regional programs.

To ensure that all Californians are included in efforts to address climate change, California will also support highly localized efforts at public education and outreach at the community and neighborhood level. This includes service club organizations and existing faith-based communities – churches, mosques and synagogues. Other private-sector entities including businesses and local chambers of commerce will be invited to partner in spreading the word.

1. Involving the Public and Stakeholders in Measure Development

In keeping with the requirements of AB 32 and the legacy of four decades of regulatory development at ARB, we have worked to make this process fully transparent and will continue to do so as regulations to implement the plan are developed. We will continue our efforts to involve the public to the greatest extent feasible at every stage of the process, including informal and formal rulemaking activities. This will include disadvantaged communities and those with localized concerns, as well as affected industries and small businesses.

Local and community meetings and outreach have been and will continue to be a central element of all rulemaking, with State agencies working closely with disadvantaged communities, EJAC, public health experts, and other stakeholders to fully evaluate the impacts associated with California's greenhouse gas emissions reduction strategies. State agencies involved in measure development will continue to meet periodically with communities to assess any challenges to implementation, or to discover possible new measures or approaches. Stakeholders will be invited to participate in the many additional workshops, workgroups and seminars that will be held as individual measures are developed.

2. Education and Workforce Development

The transition to a clean energy future presents California with a tremendous opportunity to continue growing its green economy and to expand the growth of green job opportunities throughout the state. Making this transition will require a technically educated workforce that is equipped with the skills to develop and deploy 21st century technologies. Investments in training, career technical education, worker

transition assistance, and collaboration between public and private partners will be key to ensuring that California fully reaps the economic and job opportunities that will accompany implementation of AB 32.

Setting California on track to a low-carbon future beyond 2020 will be a multi-generational challenge. To meet this challenge, climate-related education in schools must be a central element of California's plan. By 2010, California will develop climate change education components to the State's new K-12 model school curriculum as part of the Education and the Environment Initiative (AB 1548, Pavley, Chapter 665, Statutes of 2003). Expanding the knowledge and opportunities of young people to participate in promoting their own and their communities' environmental health will be an important theme for all these efforts. In the meantime, ARB's educational outreach will continue through the Cool California web pages (www.coolcalifornia.org) and the continued support of student educators through the California Climate Champions programs. ARB will also rely on partners throughout the state to develop and display options for curricula that will enhance the K-12, community college, trade technical training programs, and programs at four-year colleges.

The demand for workers to fill green jobs is rising. There are currently more than 3,000 green businesses in the state, accounting for about 44,000 jobs: 36 percent of these jobs are in professional, scientific, and technical services; 19 percent are in construction; and 15 percent are in manufacturing.[76] Some of these jobs are in new fields, yet many others are simply augmentations of existing skills and vocations such as electrical, construction, machining, auto tech, and heating ventilation and air conditioning. As we move toward 2020, tens of thousands of new green job opportunities will be created.[77] Whether these opportunities come in entirely new fields of employment or in existing areas, it will be critical for California to have a trained workforce available.

Ensuring that California can continue to meet the demand for green jobs will require close coordination between workforce development agencies, businesses, State and local governments, labor unions, and community colleges and universities. Many organizations are already developing strategies and identifying steps to simultaneously meet industry workforce needs and help build a more sustainable economy. For instance, the California Labor and Workforce Development Agency (LWDA) provides a comprehensive range of employment and training services in partnership with State and local agencies and organizations. Similar additional efforts will be crucial in ensuring that the transition to a green economy benefits working

[76] California Economic Strategy Panel. *Clean Technology and the Green Economy; Growing Products, Services, Businesses and Jobs in California's Value Network*, Draft, March 2008. http://www.labor.ca.gov/panel/pdf/DRAFT_Green_Economy_031708.pdf

[77] Tellus Institute and MRG Associates. *Clean Energy: Jobs for America's Future.* As cited in: *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?* Energy and Resources Group/Goldman School of Public Policy at University of California, Berkeley. April 13, 2004. p. 11 http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf

families in California by providing a steady supply of livable-wage jobs. In the area of energy efficiency, the California Long Term Energy Efficiency Strategic Plan, adopted by the CPUC, details a vision and supporting strategies for the development of a workforce trained and engaged to achieve California's energy-efficiency objectives.

The following strategies will be key to ensure that California's workforce is equipped to help lead the transition to a clean energy future:

- **Strengthen and expand access to Career and Technical Education (CTE) in California public schools for the next generation of workers who will build a green economy.** Over the past several decades, there has been a steady decline in career and technical education. In 2007, less than one-third of all high school students in the state were enrolled in some form of CTE.[78] To take full advantage of the emerging green economy and meet the goals of AB 32, California needs to expand opportunities for CTE in schools. This could include pursuing strategies such as requiring CTE coursework for all middle- and high-school students; increasing the number of CTE credentialed teachers; expanding investment in facilities and equipment for career and technical education; and aligning educational curricula more closely with the skill and workforce needs of the emerging green economy.

- **Ensure an adequate pipeline of skilled workers who are trained in the new technologies of a greener economy.** While some green jobs will be in new businesses and new occupations, most green jobs are variations of traditional occupations in sectors like construction, utilities, manufacturing and transportation.[79] In light of the fact that forty percent of the nation's skilled workers are slated to retire in the next 5 to 10 years,[80] there is an urgent need for educational and training programs to fill these jobs. Strategies to create a steady pipeline of skilled workers include expanding curriculum choices in schools, colleges, and universities to fully reflect career opportunities available in an economy increasingly centered on clean technologies. Other strategies include offering a greater array of industry- and technology-specific courses that would link directly with postsecondary training such as apprenticeship programs, vocational training, or college.

- **Ensure that California's higher education institutions continue to produce the next generation of clean tech engineers, scientists and business leaders.** In addition to providing valuable research on potential climate-change mitigation and adaptation strategies, California's world-class research institutions are the

[78] Get REAL. *Aligning California's Public Education System with the 21st Century Economy Policy Paper for Discussion at Governor Arnold Schwarzenegger's Summit on Career and Technical Education*, March 6, 2007

[79] Ibid.

[80] The New Apollo Program, Clean Energy, Good Jobs: A National Economic Strategy for the New American Century, July 2008. p. 20 http://apolloalliance.org/downloads/fullreportfinal.pdf (accessed October 12, 2008)

incubators for many of the clean tech companies that will contribute to California's environmental and economic future. It will be critical for California to continue to cultivate university research and training programs in a way that takes full advantage of this valuable state resource.

A successful transition to a clean energy future depends heavily on California's ability to provide a well-trained workforce to meet the demands of the growing green economy. ARB and our key partners will continue working throughout the state to ensure that an adequate supply of skilled workers is positioned to take advantage of the growing opportunities for high quality jobs and careers that implementation of AB 32 will bring.

3. Small Businesses

Small businesses play a crucial role in California's economy. As noted in Chapter III, our analysis indicates that this plan will have a net positive impact on small businesses. These impacts are attributable primarily to the measures in the plan that will deliver significantly greater energy and fuel efficiencies. However, as also noted in the analysis, ensuring that these benefits are realized to the fullest potential will require additional outreach and communication efforts by ARB and many other state and local entities.

One of ARB's Early Action measures is designed to help businesses during AB 32 implementation. With our State partners, we are developing an on-line small business "toolkit" designed for small and medium-sized businesses that will provide a one-stop shop for technical and financial resources. Toolkit components will include a business-specific calculator to assess a company's carbon footprint; a voluntary greenhouse gas inventory protocol for measuring greenhouse gas emissions; recommended best practices for energy, transportation, building, purchasing, and recycling; case studies demonstrating how small and medium California businesses have reduced greenhouse gas emissions; program financing resources; peer-networking opportunities; and an awards program to recognize reductions of greenhouse gas emissions among California businesses.

ARB will also continue working with the many business associations, organizations, and other State partners, such as the Small Business Advocate's AB 32 Small Business Task Force, the Labor and Workforce Development Agency, and Business, Transportation, and Housing Agency that have the resources, input and expertise to provide. These partners will help to further develop and implement an effective outreach plan to provide technical assistance to businesses through a variety of means, including attendance at business events, workshops, and working with local economic development agencies.

C. Implementation of the Plan

This Scoping Plan outlines the regulations and other mechanisms needed to reduce greenhouse gas emissions in California. ARB and other State agencies will work closely

with stakeholders and the public to develop regulatory measures and other programs to implement the Plan. ARB and other State agencies will develop any regulations in accordance with established rulemaking guidelines. Table 32 shows the status of the proposed measures in the plan.

Table 32: Status of Scoping Plan Measures

Existing Laws, Regulations, Policies And Programs
Light-Duty Vehicle Greenhouse Gas Standards (Pavley I)
Renewables Portfolio Standard (to 20%)
Solar Hot Water Heaters
Million Solar Roofs
High Speed Rail
Measures Strengthening & Expanding Existing Policies & Programs
Electricity Efficiency
Natural Gas Efficiency
Renewables Portfolio Standard (from 20% to 33%)
Sustainable Forests
Light-Duty Vehicle Greenhouse Gas Standards (Pavley II)
Discrete Early Actions
Low Carbon Fuel Standard
High GWP in Consumer Products (Adopted)
Smartways
Landfill Methane Capture
High GWP in Semiconductor Manufacturing
Ship Electrification (Adopted)
SF6 in non-electrical applications
Mobile Air Conditioner Repair Cans
Tire Pressure Program
New Measures
California Cap-and-Trade Program Linked to WCI Partner Jurisdictions
Increase Combined Heat and Power
Regional Transportation-Related GHG Targets
Goods Movement Systemwide Efficiency
Vehicle Efficiency Measures
Medium/Heavy Duty Vehicle Hybridization
High GWP Reductions from Mobile Sources
High GWP Reductions from Stationary Sources
Mitigation Fee on High GWP Gases
Oil and Gas Extraction
Oil and Gas Transmission
Refinery Flares
Removal of Methane Exemption from Existing Refinery Regulations

Rulemakings will take place over the next two years. As with all rulemaking processes, there will be ample opportunity for both informal interaction with technical staff in meetings and workshops, and formal interaction. ARB will consider all information and stakeholder input during the rulemaking process. Based on this information, ARB may modify proposed measures to reflect the status of technological development, the cost of the measure, the cost-effectiveness of the measures and other factors before presenting them to the Board for consideration and adoption.

In addition to these existing approaches, AB 32 imposes other requirements for the rulemaking process. Section 38562(b) explicitly added requirements for any regulations adopted for greenhouse gas emissions reductions. ARB also recognizes the need to expand the scope of analysis required when adopting future greenhouse gas emission reduction regulations. These expanded evaluations include the unique enforcement nature of climate change-related regulations and the possible extended permitting considerations and timelines that must be taken into account when establishing compliance dates. An important consideration in developing regulations will be the potential impact on California businesses. The potential for leakage, the movement of greenhouse gas emissions (and economic activity) out of state, will be carefully evaluated during the regulatory development.

As noted above, as the Scoping Plan is implemented and specific measures are developed, ARB and other implementing agencies will also conduct further CEQA analyses, including cumulative and multi-media impacts. ARB must design equitable regulations that encourage early action, do not disproportionately impact low-income and minority communities, ensure that AB 32 programs complement and do not interfere with the attainment and maintenance of ambient air quality standards, consider overall societal benefits (such as diversification of energy resources), minimize the administrative burden, and minimize the potential for leakage. AB 32 requires that, to the extent feasible and in furtherance of achieving the statewide greenhouse gas emission limit, ARB must consider the potential for direct, indirect and cumulative emission impacts from market-based compliance mechanisms, including localized impacts in communities that are already adversely impacted by air pollution, design the program to prevent any increase in emissions, and maximize additional environmental and economic benefits prior to the inclusion of market-based compliance mechanisms in the regulations. As ARB further develops its approach for consideration of these issues in future rulemakings, and updates needed analytical tools and data sets, we will consult with outside experts and the EJAC.

ARB already conducts robust environmental and environmental justice assessments of our regulatory actions. Many of the requirements in AB 32 overlap with ARB's traditional evaluations. In adopting regulations to implement the measures recommended in the Scoping Plan, or including in the regulations the use of market-based compliance mechanisms to comply with the regulations, ARB will ensure that the measures have undergone the aforementioned screenings and meet the requirements established in HSC §38562 (b) (1-9) and §38570 (b) (1-3).

D. Tracking and Measuring Progress

Many State agencies, working with the diverse set of greenhouse gas emissions sources, have collaborated in the process of developing the strategies presented in this plan. As the agency responsible for ensuring that AB 32 requirements are met, ARB must track the regulations adopted and other actions taken by both ARB and other State agencies as the plan is implemented.

The emissions reductions enumerated in this plan are estimates that may be modified based on additional information. As the proposed measures are developed over the coming years, it is possible that some of these strategies will not develop as originally thought or not be technologically feasible or cost-effective at the level given in the plan. It is equally likely that new technologies and strategies will emerge after the initial adoption schedule required in AB 32, that is, regulation adoption by January 1, 2011. If promising new tools or strategies emerge, ARB and other affected State agencies will evaluate how to incorporate the new measures into the AB 32 program. In this way, new strategies ensuring that the commitments in the plan remain whole and that the 2020 goal can be met will be incorporated into the State strategy.

ARB will update the plan at least once every five years (HSC §38561(h)). These updates will allow ARB to evaluate the progress made toward the State's greenhouse gas emission reduction goals and correct the Plan's course where necessary. This section discusses the tracking and measurement of progress that ARB envisions. The Report Cards and audits, along with an evaluation of new technologies – both emerging and those recently incorporated into the Plan – will also provide valuable input into ARB's update process. Continuous atmospheric monitoring of greenhouse gases may also be useful for determining the effectiveness of emission reduction strategies and for future inventory development.

1. Report Card

SB 85 (Budget Committee, Chapter 178, Statutes of 2007) requires every State agency to prepare an annual "Report Card," detailing measures the agency has adopted and taken to reduce greenhouse gas emissions, including the actual emissions reduced as a result of those actions. The information must be submitted to CalEPA, which is then required to compile all the State agency data into a report format, which is made available on the Internet and submitted to the Legislature. The information allows comparisons of each agency's projected and actual greenhouse gas emissions reductions with the targets established by the CAT or the Scoping Plan. This would be the State's 'Report Card' on its efforts to reduce greenhouse gas emissions.

Agencies are also required, as funds are available, to have an outside audit of greenhouse gas-related actions completed every three years to verify actual and projected reductions.

2. Tracking Progress by Implementing Agencies

As the lead agency responsible for implementing AB 32, ARB must track the progress of both our efforts and the efforts of our partners in implementing their respective provisions of this plan. Communication between ARB and the other implementing agencies will be especially important as regulations and programs are developed. In support of the Report Card requirement noted above, ARB will work with CalEPA to develop a process to track and report on progress toward the plan's goals and commitments.

3. Progress Toward the State Government Target

The CAT recently established a State Government Subgroup to work with State agencies to create a statewide approach to meet the Scoping Plan's commitment to reduce greenhouse gas emissions by a minimum of 30 percent by 2020 below the State's estimated business-as-usual emissions – approximately a 15 percent reduction from current levels. State agencies must lead by example by doing their part to reduce emissions and employ practices that can also be transferred to the private sector. The statewide plan will serve as a guide for State agencies to achieve realistic, measurable objectives within specific timelines. This newly created State Government Subgroup will assist State agencies through these steps in a timely manner.

4. Mandatory Reporting Regulation

ARB's mandatory reporting rule, adopted in December 2007, will help the State obtain facility-level data from the largest sources of greenhouse gas emissions in California. This data will help ARB better understand these sources to develop the proposed emissions reduction measures outlined in this plan.

The regulation requires annual reporting from the largest facilities in the state, accounting for 94 percent of greenhouse gas emissions from industrial and commercial stationary sources in California. There are approximately 800 separate sources that fall under the new reporting rules, which include electricity generating facilities, electricity retail providers and power marketers, oil refineries, hydrogen plants, cement plants, cogeneration facilities, and industrial sources that emit over 25,000 tons of carbon dioxide each year from on-site stationary source combustions such as large furnaces. This last category includes a diverse range of facilities such as food processing, glass container manufacturers, oil and gas production, and mineral processing.

Affected facilities will begin tracking their greenhouse gas emissions in 2008, to be reported beginning in 2009 with a phase-in process to allow facilities to develop reporting systems and train personnel in data collection. Emissions for 2008 may be based on best available data. Beginning in 2010, emissions reports will be more rigorous and will be subject to third-party verification. Reported emissions data will allow ARB to improve its facility-based emissions inventory data. Originally, the statewide greenhouse gas inventory was based on aggregated sector data and could

not be broken down to the facility level. The facility-level reporting required under the Mandatory Reporting regulation will improve data on greenhouse gas emissions for individual facilities and their emitting processes. This information could also help improve emissions inventories for criteria pollutants, and provide additional data for assessing cumulative emission impacts on a community level.

ARB emissions reporting requirements are expected to be modified over time as AB 32 is implemented.

E. Enforcement

Enforcement is a critical component of all of the State's regulatory programs, both to ensure that emissions are actually reduced and to provide a level playing field for entities complying with the law. To meet the 2020 target this plan calls for aggressive action by a number of State agencies. Each of those agencies will employ its full range of compliance and enforcement options to ensure that planned reductions are achieved. The remainder of this section discusses ARB's portion of the enforcement program in more detail.

ARB has an extensive and effective enforcement program covering a wide variety of regulated sources, from heavy-duty vehicle idling, to consumer products, to fuel standards and off-road equipment. To increase the effectiveness of its enforcement efforts and provide greater assurance of compliance, ARB also partners with local, State and federal agencies to carry out inspections and, when necessary, prosecute violators.

ARB will continue its strong enforcement presence as the State's primary air pollution control agency. A critical function of this responsibility is to ensure that all enforcement actions are timely, effective, and appropriate with the severity of the situation. ARB will also continue its close working relationship with local air districts in the development and enforcement of applicable regulations contained within the Scoping Plan and collaborate with the appropriate State agencies on greenhouse gas emission reductions measures.

For the stationary source regulations called for in the plan, ARB will work closely with the local air districts that have primary responsibility for implementing and enforcing criteria pollutant regulations. Not only are local air districts familiar with the individual facilities and their compliance history, but information contained in district permits can be used to verify the accuracy of greenhouse gas emissions reported by sources subject to ARB mandatory reporting requirements. Using this data, regulators can also examine any correlation between greenhouse gases and toxic or criteria air pollutants as a result of emissions trading or direct regulations.

ARB will also continue to partner with the California Highway Patrol and other State and local enforcement agencies on mobile source and other laws and regulations where joint enforcement authorities apply.

Although many of the measures in the Scoping Plan are modeled on existing ARB regulations, a multi-sector, regional cap-and-trade program would bring unique enforcement challenges. ARB and CalEPA have begun the process of engaging and consulting with other State agencies, such as California's Department of Justice, Public Utilities Commission, Energy Commission, as well as the Independent System Operator, on market tracking and enforcement. These working group meetings are ongoing and will culminate in a comprehensive enforcement plan to accompany the proposed cap-and-trade program when the Board considers regulatory requirements. This enforcement plan would describe the administrative structures needed for market monitoring, prosecution, and penalty setting. Public input regarding these issues would also be a key part of the public stakeholder process conducted during development of the cap-and-trade programs regulations.

Accurate measurement and reporting of all emissions would be necessary to assure accountability, establish the integrity of allowances, and provide sufficient transparency to sustain confidence in the market. To ensure compliance, ARB would administer penalties for entities that hold an insufficient quantity of allowances to cover their emissions or fail to report their greenhouse gas emissions. Missed compliance deadlines would also result in the application of stringent administrative, civil, or criminal penalties.

This plan recommends that California implement a cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system. This system would require California to formalize enforcement agreements with its WCI partner jurisdictions for all phases of cap-and-trade program operations, including verification of emissions, certification of offsets based on common protocols, and detection of and punishment for non-compliance. As needed, California would also work with federal regulatory and enforcement agencies that oversee trading markets, such as the Commodity Futures Trading Commission and the Federal Energy Regulatory Commission. While California would work with other jurisdictions on joint enforcement activities, ARB will exercise all of its authority under HSC §38580 and other provisions of law to enforce its regulations against any violator wherever they may be.

F. State and Local Permitting Considerations

Some of the proposed emissions reduction strategies in this Scoping Plan may require affected entities to modify or obtain state or local permits. California's existing permit process ensures that health and safety concerns are evaluated, met, and when appropriate, mitigated. The State recognizes the potential for conflicts between various federal, state and local permitting requirements, which may cross various media – air, water, etc. CalEPA is actively involved in identifying and addressing these regulatory overlap issues with the ultimate goal of consolidating permits where feasible while maintaining all permit requirements. Two such examples are CalEPA's digester permit working group and the CalEPA-Air District Compost Emissions Work Group.

ARB recognizes that the permitting process may affect the viability of certain strategies and that the length of the permitting process could affect the timing of emissions reductions.

ARB, along with CalEPA and other State agencies, will continue to evaluate steps to ensure that permit requirements harmonize across the affected media.

This Plan has been developed with an understanding of the important cross-media impacts. These efforts will continue during the implementation of the Plan. Particular focus on the potential permitting impacts and cross-media consequences of a proposed rule will take place during the rulemaking process.

G. Role of Local Air Districts

Local air districts are ARB's partners in addressing air pollution. ARB takes primary responsibility for transportation, off-road equipment and consumer products. Local districts lead in controlling industrial, commercial and other stationary sources of air emissions. AB 32 recognizes the need to develop a program that meshes with local and regional activities. Although AB 32 does not provide an explicit role for air districts, their local presence as advocates for clean air and their resources, experience and expertise in regulating and enforcing rules for stationary sources make them a logical choice to have an important role in several aspects of implementing California's greenhouse gas program. ARB would partner with local air districts to develop and effectively enforce both source-specific requirements on industrial sources, and to enforce related programs, such as the high GWP rules, that affect a large number of local businesses.

ARB and local air districts are also actively working to coordinate emission reporting requirements. Some districts, like the South Coast Air Quality Management District, have developed software to allow their industrial sources to simultaneously report their criteria pollutant emissions to the District and their greenhouse gas emissions to ARB. Many air district staff are being trained as third-party verifiers to confirm the greenhouse gas emissions information provided by industrial sources under the mandatory reporting regulation, and, similarly, could provide verification of voluntary greenhouse gas reductions in the future.

Local air districts will be key in both encouraging greenhouse gas emissions reductions from other regional and local government entities, and providing technical assistance to quantify and verify those reductions. Local agencies are an important component of ARB's outreach strategy.

Many local air districts have already taken a leadership role in addressing greenhouse gas emissions in their communities. These efforts are intended to encourage early voluntary reductions. For example, local districts are "lead agencies" under the California Environmental Quality Act (CEQA) for some projects. In order to ensure high-quality mitigation projects, some districts have established programs to encourage local greenhouse gas reductions that could be used as CEQA mitigation. As the State begins to institutionalize mechanisms to generate and verify greenhouse gas emissions reductions, ARB and the districts must work together to smoothly transition to a cohesive statewide program with consistent technical standards.

H. Program Funding

Administration, implementation, and enforcement of the emissions reduction measures contained in the Scoping Plan will require a stable and continuing source of funding. AB 32 authorizes ARB to collect fees to fund implementation of the statute. ARB recently initiated a rulemaking for a fee program to fund administration of the program.

Approximately $36 million per year will be needed on an ongoing basis to fund implementation by ARB and other State agencies, based on the positions and funding included in the 2009-2010 fiscal year budget. Additional revenues are needed to repay the loans from State funds that were used to pay ARB and CalEPA expenses in the startup of the program. ARB is moving on an expedited schedule to develop a fee regulation and expects to take a regulation to the Board in mid 2009, with the aim of beginning to collect fees in the 2009/2010 fiscal year.

V. A VISION FOR THE FUTURE

California has the know-how, ingenuity, research capabilities, and culture of innovation to meet the challenge of addressing climate change. However, reaching the goals we have set for ourselves will not be easy. Successful implementation of many of the proposed programs and measures described in this plan will require strong leadership and a shared understanding of the need to reach viable and lasting solutions quickly.

This challenge will also require establishing a wide range of partnerships, both within California and beyond our borders. We will need to support additional research, and further develop our culture of innovation and technological invention. In order to continue the momentum and the commitment to a clean energy future, we will need to both build on existing solutions and develop new ones.

The following sections lay out some of the elements that will be necessary to forge a broad-based institutional strategy to address climate change both within California and beyond. Also discussed is the need to build partnerships on the regional, national and international levels to ensure that our actions complement and support those being taken on a global scale. This section also looks forward to 2030, showing that California is on the trajectory needed to do our part to stabilize global climate.

A. Collaboration

1. Working Closely with Key Partners

True climate change mitigation will require many parties to work together for a global mitigation plan. California and other states are filling a vacuum created by the current lack of leadership at the federal level. By its bold actions, California is moving the United States closer to a seat at the table among the developed countries that have agreed to reduce their carbon emissions, and lead a new international effort for an agreement to replace the Kyoto Protocol that expires in 2012.

Any national climate program must be built on a partnership with State and local governments to ensure that states can continue their role as incubators of climate change policy and can implement effective programs such as vehicle standards, energy efficiency programs, green building codes, and alternative fuel development.

California will work for climate solutions with key federal agencies, including the U.S. Department of Energy and their national labs, the U.S. Environmental Protection Agency, the U.S. Bureau of Land Management, the U.S. Department of Agriculture, the U.S. Department of Transportation, and others.

Through the Western Climate Initiative and in collaboration with other regional alliances of states, California can promote its own best practices and learn from others while helping to formulate the structure of a regional and ultimately national cap-and-trade program.

2. International

As one of the largest economies in the world, California is committed to working at the international level to reduce global greenhouse gas emissions. As part of this effort, Governor Schwarzenegger and other U.S. governors taking the lead in climate change are co-hosting a Global Climate Summit on Finding Solutions Through Regional and Global Action. This summit, held on November 18th and 19th, 2008, began a state-province partnership with leaders from the U.S., Australia, Brazil, Canada, China, India, Indonesia, Mexico, the European Union, and other nations, taking urgent steps to contain global climate change and jointly setting forth a blueprint for the next global agreement on climate change solutions.

California is also a charter member of the International Carbon Action Partnership (ICAP), an organization composed of countries and regions that have adopted carbon caps and that are actively pursuing the implementation of carbon markets through mandatory cap-and-trade systems. California's continued involvement in ICAP will be very beneficial for sharing experiences and knowledge as we design our own market program.

In addition to participating in ICAP, California hopes to engage developing countries to pursue a low-carbon development path. With developing nations expected to suffer the most from the effects of climate change, California and others have an obligation to share information and resources on cost-effective technologies and approaches for mitigating both emissions and future impacts as changes in climate and the environment occur.

California recognizes the "common but differentiated responsibilities" among developed and developing countries (as articulated in the Kyoto Protocol), but the reality is that rapidly escalating greenhouse gas emissions in developing countries could possibly negate any efforts undertaken in California. To the extent that we are part of the global economy, California's demand for goods manufactured in developing countries further exacerbates growth of greenhouse gas emissions globally. Therefore, it is critical for California to help support the adoption of low-carbon technologies and sustainable development in the developing world.

California can advance the international policy debate through state-provincial partnerships for achieving early climate action in developing countries. This approach envisions commitments by developed countries to provide capacity building through technological assistance and investment support in return for developing countries adopting enhanced mitigation actions. California will consider working with developing countries or provinces that have, at a minimum, pledged to achieve greenhouse gas intensity targets in certain carbon-intensive sectors through

mechanisms, such as minimum performance standards or sector benchmarks. California also recognizes that developing countries have the challenge and responsibility to reduce domestic emissions in a way that will promote sustainable development, but not undermine their economic growth.

One possible manifestation of these collaborations could be the establishment of sectoral agreements that help to grow developing countries' economies in a low-carbon manner. In a sectoral approach, energy-intensive sectors adopt programs for reducing greenhouse gas emissions and/or energy use. Such sector-based approaches seem likely to win the support of developing countries and could also reduce concerns in developed countries about international competitiveness and carbon leakage.

A state-provincial partnership related to imported commodities (such as cement) would enable California to provide incentives to reduce greenhouse gas emissions associated with products that are imported by our state. California should continue to develop current relations and existing partnership arrangements with China – now the largest emitter of greenhouse gases in the world – because in addition to other compelling reasons much of the state's imported cement originates in China. California should also work to establish similar relations with India and other countries to share research on both greenhouse gas mitigation and climate change adaptation activities. Projects in the Mexican border region may also be of particular interest, considering the opportunity to realize considerable co-benefits on both sides of the border.

Deforestation accounts for approximately 20 percent of global greenhouse gas emissions. California has set a strong precedent in the effort to incorporate forest management and conservation into climate policy by adopting the CCAR forest methodology in October 2007. California also hopes to engage developing countries, including Brazil and Indonesia, to reduce emissions and sequester carbon through eligible forest carbon activities. Activities aimed at Reducing Emissions from Deforestation and Forest Degradation (REDD) were excluded from the rules governing the first Kyoto commitment period, but there is considerable momentum behind the effort to include provisions that would recognize such activities in a post-2012 international agreement. Providing incentives to developing countries to help cut emissions by preserving standing forests, and to sequester additional carbon through the restoration and reforestation of degraded lands and forests and improved forest management practices, will be crucial in bringing those countries into the global climate protection effort. California recognizes the importance of establishing mechanisms that will facilitate global partnerships and sustainable financing mechanisms to support eligible forest carbon activities in the developing world.

B. Research

1. Unleash the Potential of California's Universities and Private Sector

Bringing greenhouse gas emissions down to a level that will allow the climate to stabilize will take a generation or longer. Many of the ultimate solutions to achieve stabilization will be developed and implemented well into the future. Innovation in energy and climate will come from people who are now in school. These young people will face unprecedented challenges, and they will need both wisdom and imagination to craft solutions. California's respected public and private academic institutions must continue to develop and fund programs based on climate change science that cut across disciplines to address the multi-dimensional aspects of climate change.

2. Public-Private Partnerships

To most effectively address the climate change dilemma, we must encourage collaborations between academia and the private sector. Industry is well-positioned to quickly attack problems. Combining the vast knowledge housed in universities with businesses' acumen and agility can unleash a powerful collaborative force to tackle the problems associated with climate change.

Several important programs have already been initiated at California universities, including Stanford's Global Climate and Energy Project and the University of California at Berkeley's Energy Biosciences Institute (EBI).[81] These and other efforts need to be recognized and encouraged, along with others that can link the results of research directly to policy decisions that the State must make.

Carbon Sequestration

In addition to terrestrial carbon sequestration or natural carbon sinks, such as forests and soil, CO_2 can be prevented from entering the atmosphere through carbon capture and storage (CCS). This consists of separating CO_2 from industrial and energy-related sources and transporting the CO_2 to a storage location for long-term isolation from the atmosphere. Potential technical storage methods include geological storage, industrial fixation of CO_2 into inorganic carbonates, and other strategies. Large point sources of CO_2 that may pursue CCS include large power plants, fossil fuel-based hydrogen production plants, and oil refineries.[82]

[81] The EBI is being developed in cooperation with Lawrence Berkeley National Laboratory, the University of Illinois at Urbana-Champaign and BP.

[82] Intergovernmental Panel on Climate Change. *Carbon Dioxide Capture and Storage: A Special Report of Working Group III of the IPCC*. Cambridge University Press, UK; 2005. http://www.ipcc.ch/ipccreports/srccs.htm (accessed October 12, 2008)

According to a 2005 report by the Intergovernmental Panel for Climate Change (IPCC), a power plant with CCS could reduce CO_2 emissions to the atmosphere by approximately 80 to 90 percent compared to a plant without CCS (including the energy used to capture, compress and transport CO_2).[83] While more research and development needs to occur, California should both support near-term advancement of the technology and ensure that an adequate framework is in place to provide credit for CCS projects when appropriate.

The State is currently an active member of the West Coast Regional Carbon Sequestration Partnership (WESTCARB), a public-private collaboration to characterize regional carbon sequestration opportunities in seven western states and one Canadian province. Established in 2003, this research project is comprised of more than 80 public and private organizations. WESTCARB is conducting technology validation field tests, identifying major sources of CO_2 in its territory, assessing the status and cost of technologies for separating CO_2 from process and exhaust gases, and determining the potential for storing captured CO_2 in secure geologic formations.[84]

C. Reducing California's Emissions Further – A Look Forward to 2030

In order to assess whether implementing this plan achieves the State's long-term climate goals, we must look beyond 2020 to see whether the emissions reduction measures set California on the trajectory needed to do our part to stabilize global climate.

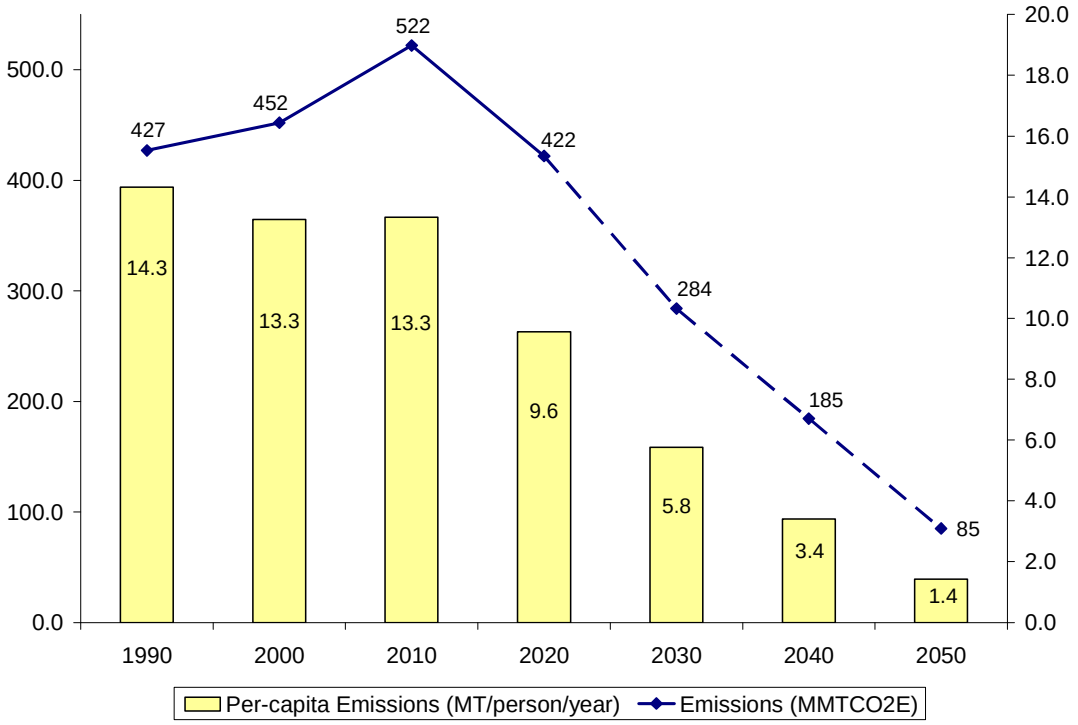
Governor Schwarzenegger's Executive Order S-3-05 calls for an 80 percent reduction below 1990 greenhouse gas emission levels by 2050. This results in a 2050 target of about 85 $MMTCO_2E$ (total emissions), as compared to the 1990 level (also the 2020 target) of 427 $MMTCO_2E$. Climate scientists tell us that the 2050 target represents the level of greenhouse gas emissions that advanced economies must reach if the climate is to be stabilized in the latter half of the 21st century. Full implementation of the Scoping Plan will put California on a path toward these required long-term reductions. Just as importantly, it will put into place many of the measures needed to keep us on that path.

Figure 6 depicts what an emissions trajectory might look like, assuming California follows a linear path from the 2020 AB 32 emissions target to the 2050 goal needed to help stabilize climate. While the measures needed to meet the 2050 goal are too far in the future to define in detail, we can examine the policies needed to keep us on track through at least 2030.

[83] Ibid

[84] WESTCARB. *WESTCARB Overview*. http://www.westcarb.org/about_overview.htm (accessed October 12, 2008)

Figure 6: Emissions Trajectory Toward 2050



To stay on course toward the 2050 target our State's greenhouse gas emissions need to be reduced to below 300 $MMTCO_2E$ by 2030. This translates to an average reduction of four percent per year between 2020 and 2030. An additional challenge comes from the fact that California's population is expected to grow by about 12 percent between 2020 and 2030. To counteract this trend, per-capita emissions must decrease at an average rate of slightly less than five percent per year during the 2020 to 2030 period.

Are such reductions possible by 2030? What measures might be able to provide the needed reductions? How do the needed measures relate to the efforts put into place to reach the 2020 goal? All of these are critical questions, and are addressed below.

The answer to the first question is yes, the reductions are possible. Furthermore, the measures needed are logical expansions of the programs recommended in the Scoping Plan that get us to the 2020 goal. We could keep on track through 2030 by extending those programs in the following ways:

- Using a regional or national cap-and-trade system to further limit emissions from the 85 percent of greenhouse gas emissions in capped sectors (Transportation Fuels and other fuel use, Electricity, Residential/Commercial Natural Gas, and Industry). By 2030 a comprehensive cap-and-trade program could lower emissions in the capped sectors from 365 $MMTCO_2E$ in 2020 to around 250 $MMTCO_2E$ in 2030;

- Achieving a 40 percent fleet-wide passenger vehicle reduction by 2030, approximately double the almost 20 percent expected in 2020;
- Increasing California's use of renewable energy;
- Reducing the carbon intensity of transportation fuels by 25 percent (a further decrease from the 10 percent level set for 2020);
- Increasing energy efficiency and green building efforts so that the savings achieved in the 2020 to 2030 timeframe are approximately double those accomplished in 2020; and
- Continuing to implement sound land use and transportation policies to lower VMT and shift travel modes.

The effects of these strategies are presented in Table 33.

Table 33: Potential Distribution of California Greenhouse Gas Emissions by Sector in 2030

Sector	Potential Emissions ($MMTCO_2E$)
Transportation Fuels*	102
Other Fuel Use*	149
Uncapped Sectors	33
Total	**284**

* Capped sector

With these polices and measures in place, per-capita electricity consumption would decrease by another five percent. Well over half of our electricity demand could be met with zero or near zero greenhouse gas emitting technologies, assuming nuclear and large hydro power holds constant at present-day levels. In response to a lower cap on emissions, existing coal generation contracts would not be renewed, or carbon capture and storage would be utilized to minimize emissions. The remaining electricity generation would come from natural gas combustion either in cogeneration applications or from highly efficient generating units.

By 2030, the transportation sector would undergo a similarly massive transition both in terms of the vehicle fleet and the diversity of fuel supplies. Due to the combination of California's clean car standards (ARB's ZEV program and the Low Carbon Fuel Standard), the number of battery-electric vehicles, plug-in hybrid electric vehicles, and fuel cell vehicles would increase dramatically, to about a third of the vehicle fleet. Flex-fuel vehicles would comprise a large fraction of the remaining fleet, with more efficient gasoline and diesel vehicles making up the difference. Electricity, advanced biofuels, improved gasoline and diesel, renewable natural gas and hydrogen would all play a role in powering this high-tech fleet of efficient vehicles.

Regional land use and transportation strategies would grow in importance and would reverse the trend of per-capita vehicle miles traveled, a reduction of about eight percent below business-as-usual in 2030. With ambitious but reasonable action, statewide passenger vehicle greenhouse gas emissions could be reduced to half of 2020 levels in 2030, which is also about half of business-as-usual for 2030. Efficiency strategies and low carbon fuels for heavy-duty and off-road vehicles, as well as for ships, rail, and aviation, would need to be greatly expanded in order to achieve additional reductions from the transportation sector in 2030.

In tandem with efficiency measures that lower demand for electricity, natural gas and transportation fuels, California's cap-and-trade program would incent large industrial sources as well as commercial and residential natural gas customers to further reduce emissions. By tightening the cap over time, it is expected that facilities in the industrial and natural gas sectors would achieve reductions well beyond those needed to meet the 2020 emissions cap.

The Scoping Plan proposes several measures for reducing high GWP gases that collectively, will substantially reduce emissions. With a transition toward reduced consumption of these gases, improved containment in their end uses, and substitution of low GWP alternative gases, it is expected that emissions from this sector could decrease by 75 percent between 2020 and 2030.

For uncapped sectors, we assume that the agriculture sector will reduce emissions by about 15 percent between 2020 and 2030. Net forest uptake of CO_2 must be preserved or enhanced, likely through both expansion of forests and reduction in carbon loss from forest fires, which are predicted to increase over this time period. This example assumes a 10 percent reduction in direct landfill emissions from the recycling and waste sector; however, aggressive implementation of the suite of measures proposed in this Plan could further reduce emissions from this sector by 2030.

In total, the measures described above would produce reductions to bring California's statewide greenhouse gas emissions to an estimated 284 $MMTCO_2E$ in 2030. While the potential mix of future climate policies articulated in this section is only an example, it serves to demonstrate that the measures in the Scoping Plan can not only move California to its 2020 goal, but also provide an expandable framework for much greater long-term greenhouse gas emissions reductions.

D. Conclusion

California's commitment to address global warming has never been greater. The vast amount of interest, support, and input that ARB has received since this plan began to take shape is evidence of a clear understanding of the need to take action and support for the State's efforts to lead the way. The time has come to shift away from a 'business-as-usual' approach to climate change and to move toward the lasting and sustainable goal of a clean energy future.

Reaching our goals will take a great deal of leadership, commitment, and a willingness to embrace new approaches and seek out new solutions. California's plan to reduce greenhouse gas emissions must also take into account the impacts of this transition and be designed in particular to address the needs of low-income communities, small businesses, and California's working families.

Reaching our goals will also require involvement and support from all levels of government in California, and a coordinated effort with other states, regions, and countries. The solutions and technologies we develop here will be used around the world to help others transition to a clean energy future and contribute to the fight against global warming.

Reaching our goals will also require flexibility. As we move forward, we must be prepared to make mid-course corrections. AB 32 wisely requires ARB to update its Scoping Plan every five years, thereby ensuring that California stays on the path toward a low carbon future.

This plan is part of a new chapter for California that in many ways began with the passage and signing of AB 32. It proposes a comprehensive set of actions designed to reduce greenhouse gas emissions in California, improve our environment, reduce our dependence on oil, diversify our energy sources, save energy, create new jobs, and enhance public health. The challenge California has taken on is large but the opportunities are even greater. It is now time to turn this plan into action.

ACKNOWLEDGMENTS

This Scoping Plan was prepared by the Air Resources Board. This document was made possible by the hard work of numerous contributors. Below is a list of advisory committees and State agencies that directly provided input to this Scoping Plan.

Team Support

Climate Action Team

Climate Action Team Sector Subgroups

- Agriculture
- Cement
- Energy
- Forest
- Green Buildings
- Land Use
- Recycling and Waste Management
- State Fleet
- Water-Energy
- Economics

Advisory Committees

Market Advisory Committee

Environmental Justice Advisory Committee

Economic and Technology Advancement Advisory Committee

State Agencies

Governor's Office of Planning and Research

California Environmental Protection Agency

Business, Transportation and Housing Agency

Resources Agency

State and Consumer Services Agency

Department of Food and Agriculture

California Energy Commission

California Public Utilities Commission

California Transportation Commission

Department of Conservation

Department of Forestry and Fire Protection

Department of General Services

Department of Parks and Recreation

Department of Public Health

Department of Toxic Substances Control

Department of Transportation

Department of Water Resources

Housing and Community Development

Integrated Waste Management Board

Office of Environmental Health Hazard Assessment

State Water Resources Control Board

Department of Pesticide Regulation

BOARD RESOLUTION

State of California
Air Resources Board

Climate Change Scoping Plan

Resolution 08-47

December 11, 2008

Agenda Item No.: 08-10-2

WHEREAS, the Legislature has enacted the Global Warming Solutions Act of 2006 (AB 32; Health and Safety Code section 38500 et seq.), which declares that global warming poses a serious threat to the environment of California and creates a comprehensive multi-year program to reduce greenhouse gas (GHG) emissions that cause global warming;

WHEREAS, the adverse impacts of climate change include more droughts, more frequent and extreme heat waves, erratic storm and flood events, decreases in winter snowpack, a rise in sea level, increases in water temperatures, an increase in coastal erosion, intrusion of sea water, an increase in the duration of wildfire season, and increased occurrences of unhealthy ozone levels;

WHEREAS, climate change mitigation and adaptation measures can be complementary and are often intricately linked;

WHEREAS, AB 32 designates the Air Resources Board (ARB or the Board) as the State agency charged with monitoring and regulating sources of GHG emissions in California in order to reduce these emissions;

WHEREAS, section 38561(a) of the Health and Safety Code directs the Board, on or before January 1, 2009, to prepare and approve a Scoping Plan for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions by 2020;

WHEREAS, section 38561(a) of the Health and Safety Code also requires ARB to consult with all State agencies having jurisdiction over sources of GHGs on all elements of the Scoping Plan that pertain to energy-related matters, to ensure reduction activities adopted and implemented by ARB are complementary, non-duplicative and can be implemented in an efficient and cost-effective manner;

WHEREAS, section 38561(b) of the Health and Safety Code requires the Scoping Plan to identify and make recommendations on direct emission reduction measures, alternative compliance mechanisms, market-based compliance mechanisms, and potential monetary and nonmonetary incentives for sources and categories of sources that the Board finds necessary or desirable to facilitate the achievement of the maximum feasible and cost-effective reductions of GHG emissions by 2020;

WHEREAS, section 38561(c) of the Health and Safety Code requires ARB to consider all relevant information pertaining to greenhouse gas emissions reduction programs in other states, localities, and nations, including the northeastern states of the United States, Canada and the European Union in making the determinations required in Health and Safety Code section 38561(b);

WHEREAS, section 38561(d) of the Health and Safety Code requires ARB to evaluate the total potential costs and total potential economic and noneconomic benefits of the Scoping Plan to California's economy, environment, and public health, using the best available economic models, emissions estimation techniques, and other scientific methods;

WHEREAS, section 38561(e) of Health and Safety Code requires ARB, in developing its plan, to take into account the relative contribution of each source or source category to statewide GHG emissions, and the potential for adverse effects on small businesses, and to recommend a de minimis threshold of GHG emissions below which emission reduction requirements will not apply;

WHEREAS, section 38561(f) of the Health and Safety Code requires ARB, in developing its plan, to identify opportunities for emission reductions measures from all verifiable and enforceable voluntary actions, including, but not limited to, carbon sequestration projects and best management practices;

WHEREAS, section 38561(g) of the Health and Safety Code requires ARB to conduct a series of public workshops to give interested parties an opportunity to comment on the Scoping Plan, and that a portion of these workshops should take place in regions that have the most significant exposure to air pollution, including, but not limited to communities with minority populations, communities with low-income populations, or both;

WHEREAS, section 38652(b) of the Health and Safety Code requires ARB, in adopting greenhouse gas regulations, to the extent feasible and in furtherance of achieving the statewide greenhouse gas emissions limit, to design the regulations in a manner that is equitable and seeks to minimize costs and maximize the total benefits to California; ensure that activities taken to comply with the regulations do not disproportionately impact low-income communities; ensure that activities undertaken pursuant to the regulations complement efforts to achieve and maintain ambient air quality standards and to reduce toxic air contaminant emissions; consider the cost-effectiveness of the regulations; consider overall societal benefits; minimize administrative burden; and minimize leakage;

WHEREAS, section 38565 of the Health and Safety Code requires ARB to ensure that greenhouse gas emission reduction rules, regulations, programs, mechanisms and incentives under ARB's jurisdiction, where applicable and to the extent feasible, direct public and private investment toward the most disadvantaged communities in California;

WHEREAS, sections 39600 and 39601 of the Health and Safety Code authorize the ARB to adopt standards, rules and regulations and to do such acts as may be necessary for the proper execution of the powers and duties granted to and imposed upon the ARB by law;

WHEREAS, ARB has adopted and is implementing numerous programs to reduce criteria pollutants, diesel particulate, and air toxics emissions, including the 2007 State Implementation Plan, the Goods Movement Emissions Reduction Plan, and the Diesel Risk Reduction Plan;

WHEREAS, local air pollution control and air quality management districts are currently responsible for implementing many programs that regulate air pollution from stationary and area sources;

WHEREAS, the Board acknowledges the importance of ensuring adequate and reliable energy supplies while the State implements AB 32;

WHEREAS, in preparing the Proposed Scoping Plan, ARB staff considered advice and input from the Environmental Justice Advisory Committee and the Economic and Technology Advancement Advisory Committee;

WHEREAS, in June 2008 ARB staff prepared and circulated for public review a *Draft Climate Change Scoping Plan* (Draft Plan); staff then held three public workshops to discuss the Draft Plan, considered public comments received on the Draft Plan, and modified the Draft Plan in response to these comments;

WHEREAS, in October 2008 ARB staff prepared and circulated for public review a *Proposed Climate Change Scoping Plan*, in accordance with the requirements set forth in Health and Safety Code section 38561;

WHEREAS, the California Environmental Quality Act (CEQA) requires that no project which may have significant adverse environmental impacts may be adopted as originally proposed if feasible alternatives or mitigation measures are available to reduce or eliminate such impacts, unless specific overriding considerations are identified which outweigh the potential adverse consequences of any unmitigated impacts;

WHEREAS, CEQA allows public agencies to prepare a plan or other written documentation in lieu of an environmental impact report (i.e., a functional equivalent environmental document), once the Secretary of the Resources Agency has certified an agency's regulatory program pursuant to section 21080.5 of the Public Resources Code;

WHEREAS, pursuant to section 21080.5 of the Public Resources Code, the Secretary of the Resources Agency has certified that portion of ARB's regulatory program that

involves the adoption, approval, amendment, or repeal of standards, rules, regulations, or plans;

WHEREAS, Board regulations under ARB's certified regulatory program provide that prior to taking final action on any proposal for which significant environmental issues have been raised, the decision maker shall approve a written response to each such issue;

WHEREAS, on October 15, 2008, ARB staff prepared and circulated for public review, in accordance with CEQA and Board regulations, a functional equivalent environmental document which is set forth in Appendix J to the *Proposed Climate Change Scoping Plan*;

WHEREAS in consideration of the *Proposed Climate Change Scoping Plan*, the written and oral testimony presented by the public, industry and government agencies, and the environmental documentation prepared by Board staff, the Board finds that:

1. ARB staff has consulted with all State agencies, including the Public Utilities Commission (PUC) and the State Energy Resources Conservation and Development Commission (CEC), having jurisdiction over sources of greenhouse gases on all elements of the Plan that pertain to energy-related matters, as required by Health and Safety Code section 38561(a);

2. ARB has carefully considered the joint opinion adopted by the PUC and CEC on October 17, 2008, which recommends strategies to help reduce greenhouse gas emissions from the electricity and natural gas sectors;

3. The recommendations in the *Proposed Scoping Plan* are necessary or desirable to facilitate the achievement of the maximum feasible and cost-effective reductions of greenhouse gas emissions by 2020;

4. ARB has considered all relevant information pertaining to greenhouse gas emissions reduction programs in other states, localities, and nations, including the northeastern states of the United States, Canada and the European Union, as provided in Health and Safety Code section 38561(c);

5. ARB staff prepared an analysis to evaluate the total potential costs and total potential economic and noneconomic benefits of the *Proposed Climate Change Scoping Plan* to California's economy, environment, and public health; this analysis was prepared using the best available economic models, emissions estimation techniques, and other scientific methods, as required by Health and Safety Code section 38561(d);

6. In developing the *Proposed Climate Change Scoping Plan*, ARB took into account the relative contribution of each source or source category to

statewide GHG emissions, and the potential for adverse effects on small businesses, as provided in Health and Safety Code section 38561(e);

7. The *Proposed Climate Change Scoping Plan* recommends a de minimis threshold of GHG emissions below which emission reduction requirements will not apply, as provided in Health and Safety Code section 38561(e);

8. The *Proposed Climate Change Scoping Plan* identifies opportunities for emission reductions measures from all verifiable and enforceable voluntary actions, as provided in Health and Safety Code section 38561(f);

9. In accordance with Health and Safety Code section 38561(g), ARB staff organized over 250 public workshops, workgroup events and formal meetings throughout the State, and participated in over 350 meetings and conferences involving external stakeholders, including workshops in regions of the state that have the most significant exposure to air pollutants;

10. The *Proposed Climate Change Scoping Plan* meets all of the requirements of AB 32.

WHEREAS, pursuant to the requirements of the California Environmental Quality Act and the Board's regulations under its certified regulatory program, the Board further finds that:

11. ARB staff prepared a functional equivalent environmental document for the *Proposed Climate Change Scoping Plan* which indicates that there may be potential adverse environmental impacts from the measures included in the Plan; however, these impacts are speculative and cannot be quantified or further described until the details of the measures are developed and set forth in actual proposed regulations;

12. The Board has considered alternatives to the measures identified in the *Proposed Climate Change Scoping Plan* and has identified no feasible alternatives at this time which would reduce or eliminate any potential adverse environmental impacts, while at the same time ensuring that necessary reductions in greenhouse gas emissions will be achieved;

13. At this time there are no feasible mitigation measures that ARB can impose to lessen the potential adverse impacts of the *Proposed Climate Change Scoping Plan* on the environment, and no less stringent alternatives that will accomplish the goals imposed by AB 32 with fewer potential environmental impacts;

14. None of modifications to the *Proposed Climate Change Scoping Plan* alter any of the conclusions reached in the functional equivalent environmental

document, or would require recirculation of the document as provided in CEQA Guidelines section 15088.5;

15. The potential adverse environmental impacts of the measures included in the *Proposed Climate Change Scoping Plan* are outweighed by the substantial reduction in greenhouse gas emissions and public health benefits that will result from their adoption and implementation;

16. The considerations identified above override any adverse environmental impacts that may occur from adoption and implementation of the *Proposed Climate Change Scoping Plan*;

17. As regulations implementing the *Proposed Climate Change Scoping Plan* are developed, detailed environmental impact analyses, including a discussion of regulatory alternatives and mitigation measures, will be performed as part of the rulemaking process;

18. As regulations implementing the *Proposed Climate Change Scoping Plan* are developed, specific economic impact analyses will be performed in conjunction with the rulemaking process and will be considered by the Board in acting on those regulations;

19. In accordance with Public Resources Code 21081(a)(2), for Scoping Plan measures that are within the responsibility and jurisdiction of another public agency, that agency shall be responsible for completing the appropriate environmental review and, with respect to each significant effect identified in the environmental review, shall be responsible for adopting feasible changes or alterations to the measures to mitigate or avoid, as appropriate, the significant environmental effects that have been identified. An initial list of agencies responsible for Plan measures is included in Appendix C of the Plan.

20. ARB regulations which have been adopted and are included in the measures recommended in the *Proposed Climate Change Scoping Plan* were subjected to environmental review by the Board at the time of their adoption and no further analysis is required at this time; and

21. The Executive Officer is the decision maker for the purposes of responding to environmental issues raised on the *Proposed Climate Change Scoping Plan,* and by approving this Resolution 08-47 the Board is not prejudging any of the responses that will be made by the Executive Officer to these environmental issues.

NOW, THEREFORE, BE IT RESOLVED, that subject to the Executive Officer's approval of written responses to environmental issues that have been raised, the Board is initiating steps toward the final approval of the *Proposed Climate Change Scoping*

Plan and its Appendices, as set forth in Attachments A and B hereto, with the modifications identified at the December 11, 2008 public hearing.

BE IT FURTHER RESOLVED that the Executive Officer is the decision maker for the purposes of title 17, California Code of Regulations, section 60007; the Board directs the Executive Officer to prepare and approve written responses to all significant environmental issues that have been raised, and then to either: (1) return the *Proposed Climate Change Scoping Plan* to the Board for further consideration if it is determined that such action is warranted, or (2) take final action to approve the *Proposed Climate Change Scoping Plan* with the modifications identified at the December 11, 2008 public hearing, any conforming modifications that may be appropriate, and any modifications that are necessary to ensure that all feasible measures or feasible alternatives that would substantially reduce any significant adverse environmental impacts have been incorporated into the final action.

BE IT FURTHER RESOLVED that once final action has been taken by the Executive Officer to approve the *Climate Change Scoping Plan*, as agreed to and modified by the Board, the Board directs the Executive Officer to make the modified Plan available to the public.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to perform the environmental analyses required by CEQA in conjunction with future rulemaking actions to implement the *Climate Change Scoping Plan*, and to ensure that the potential environmental impacts identified in the Plan, and any other impacts are subsequently identified, are avoided or mitigated to the extent feasible.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to ensure that the requirements of Health and Safety Code section 38562(b) are met for all proposed regulations to implement the *Climate Change Scoping Plan*, and that the requirements of Health and Safety Code section 38570(b) are met for all proposed regulations to implement market-based compliance mechanisms.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to design greenhouse gas regulations that affect stationary sources so that they utilize, to the extent practicable and appropriate, local air district permitting programs and compliance determination mechanisms.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to provide funding to the local air districts using State funding mechanisms to reimburse districts for involvement in specific, identified activities related to implementation and enforcement of greenhouse gas emission reduction measures.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to develop a joint workplan with the local air districts to define how to efficiently and effectively implement and administer the Scoping Plan.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to develop a program to provide GHG emissions verifier training without cost to District staff who meet required education and experience qualifications.

BE IT FURTHER RESOLVED that the Board recognizes that emission sources subject to ARB's mandatory reporting regulation must report directly to the State and directs the Executive Officer to develop a software tool that will allow the export of data to the districts.

BE IT FURTHER RESOLVED that the Board recognizes that consistent implementation and enforcement of greenhouse gas emission reduction programs is crucial to minimize administrative burdens and that the future cap-and-trade program, including reporting and verification of offsets, should be administered at the state level.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to establish a working group of public health agencies and organizations, including, but not limited to, the Department of Public Health, the Office of Environmental Health Hazard Assessment, and local public health agencies, to review and provide input to the staff on proposed greenhouse gas reduction measures.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to develop a methodology using available information to assess the potential cumulative air pollution impacts of proposed regulations to implement the Scoping Plan.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to identify communities already adversely impacted by air pollution as specified in Health and Safety Code section 38570 (b)(1) before the adoption of a cap-and-trade program.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to design the implementation of AB 32, including the cap-and-trade system, to complement California's criteria and toxic air contaminant programs and be consistent with ARB's environmental justice policies, in furtherance of achieving the statewide greenhouse gas emissions limit.

BE IT FURTHER RESOLVED that the Board recognizes that through the SB 375 (Stats. 2008, Chapter 728) process, local governments and transportation agencies are key partners in ARB's efforts to reduce greenhouse gas emissions, that improved land use and transportation planning is needed to provide Californians with affordable, high quality options for housing and mobility that will result in reduced greenhouse gas emissions, and that the greenhouse gas reductions associated with more sustainable growth will increase over time.

BE IT FURTHER RESOLVED that the Board recognizes that the technical work of the SB 375 Regional Targets Advisory Committee (RTAC) is critical to building a solid foundation for Board consideration of regional targets.

BE IT FURTHER RESOLVED that as input to the SB 375 target setting process, the RTAC should recommend a method to evaluate the full potential for reducing greenhouse gas emissions in each major region of the state, and statewide, using improved land use patterns, indirect source rules, enhanced bike, walk, and transit infrastructure, and pricing policies where applicable (including congestion, toll, and parking pricing). This evaluation should be done for 2020 and 2035, employ the best available data and models, and identify barriers to achieving this full potential.

BE IT FURTHER RESOLVED that it is the Board's intent that the greenhouse gas emission reductions associated with the SB 375 regional targets represent the most ambitious achievable targets. The estimated reductions in the Scoping Plan will be adjusted to reflect the outcome of the Board's decision on SB 375 targets.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to solicit input from experts to advise ARB on its continuing evaluation of the economic effects of implementing AB 32, including identification of additional models or other economic analysis tools that could be used in the ongoing economic analysis. This will include opportunities for interested parties to share their economic modeling results.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to consider the effects of the program on the overall California economy as staff develops the cap-and-trade regulations and to take into account the joint opinion adopted by the PUC and the CEC on October 17, 2008, while recognizing that the joint opinion was developed based on consideration of the electricity and natural gas sectors, and that the recommendations in the opinion may need to be adapted to meet the needs of the California economy as a whole.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to solicit expert input on key questions related to the distribution or auction of allowances and the use of revenue.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer, as part of the cap-and-trade rulemaking, to consider the economic implications of different cap-and-trade program design options, including:

- various scenarios for allowance distribution (percent auction vs. free distribution, method of distribution);
- various scenarios for the use of auction revenue;
- the initial cap level and the rate of decline of the cap over time;
- the potential supply of offsets within and outside California; and

- the economic and co-benefit effects of limits on the use of offsets.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to coordinate the economic analysis of California's AB 32 program with the analysis conducted for the Western Climate Initiative.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to work with California small businesses during the development of Scoping Plan regulations, to consider the size of the business and type of industry in developing the regulations, and to identify financing programs that could help alleviate costs to small businesses.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to work with the CEC, the PUC and other agencies, as appropriate, to ensure that California's energy demands are met, and that the Scoping Plan and AB 32 are implemented in a manner to avoid disproportionate geographic impacts on energy rates.

BE IT FURTHER RESOLVED that the Board is committed to a cap-and-trade program as an important component of California's comprehensive program to achieve greenhouse gas reductions.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to consider the economic and public health impacts of proposed regulations to implement the Scoping Plan, as well as the requirements of section 38562(b) and 38570(b), as appropriate. For sector-specific regulations affecting sources that are also included in the cap-and-trade program, the staff shall also propose findings to identify the reasons that the emission reductions are best achieved using the proposed regulatory approach.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer, by December 31, 2009, to examine and report on:

- estimates of overall costs and savings and the cost-effectiveness of the reductions, including appropriate inclusion of reductions in co-pollutants;
- estimates of the timing of capital investments, annual expenditures to repay those investments, and the resulting cost savings;
- sensitivity of the results to changes in key inputs, including energy price forecasts and estimates of measure costs and savings; and
- impacts on small businesses.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to update the Board on the public health impacts of climate change as well as the impacts of potential measures that may be taken to mitigate climate change.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to report on the status of the Early Action Measures.

BE IT FURTHER RESOLVED that the Board, in coordination with California Environmental Protection Agency and other state agencies, will take responsibility for the tracking of Scoping Plan implementation and the development of accounting systems to promote consistency and avoid double counting of emission reductions, especially across sectors, to ensure achievement of the AB 32 goals.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to report on the status of Scoping Plan implementation to the Board twice a year.

I hereby certify that the above is a true and correct copy of Resolution 08-47, as adopted by the Air Resources Board.

Monica Vejar

Monica Vejar, Clerk of the Board

California Air Resources Board

Preliminary Draft Staff Proposal

Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under the California Environmental Quality Act

Released: October 24, 2008

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DOCUMENT AVAILABILITY

Electronic copies of this document and related materials can be found at: http://www.arb.ca.gov/cc/localgov/ceqa/ceqa.htm. Alternatively, paper copies may be obtained from the Board's Public Information Office, 1001 I Street, 1st Floor, Visitors and Environmental Services Center, Sacramento, California, 95814, (916) 322-2990.

For individuals with sensory disabilities, this document is available in Braille, large print, audiocassette or computer disk. Please contact ARB's Disability Coordinator at (916) 323-4916 by voice or through the California Relay Services at 711, to place your request for disability services. If you are a person with limited English and would like to request interpreter services, please contact ARB's Bilingual Manager at (916) 323-7053.

DISCLAIMER

This preliminary draft proposal has been reviewed by the staff of the Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation of use.

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INTRODUCTION

Climate change is one of the most serious environmental problems facing the world, the United States, and California today. In this State, climate change already is impacting our coastlines, water supplies, agriculture, and public health, and putting millions of acres of forested land at increased risk of fire. These adverse effects will only increase in number and intensity if we do not promptly and substantially reduce pollution of the atmosphere with greenhouse gases (GHGs).

California law provides that climate change is an environmental effect subject to the California Environmental Quality Act (CEQA).[1] Lead agencies therefore are obligated to determine whether a project's climate change-related effects may be significant, requiring preparation of an Environmental Impact Report,[2] and to impose feasible mitigation to substantially lessen any significant effects.[3] Determining significance, however, can be a challenging task. Accordingly, the Governor's Office of Planning and Research in its June 2008 Technical Advisory, "CEQA and Climate Change,"[4] asked the Air Resources Board (ARB) to make recommendations for GHG-related thresholds of significance – identifiable benchmarks or standards that assist lead agencies in the significance determination.[5]

With this Staff Proposal, ARB staff is taking the first step toward developing recommended statewide interim thresholds of significance for GHGs that may be adopted by local agencies for their own use. The task that ARB staff is undertaking is, however, a limited one. Staff will not attempt to address every type of project that may be subject to CEQA, but instead will focus on common project types that, collectively, are responsible for substantial GHG emissions – specifically, industrial, residential, and commercial projects.[6] ARB staff believes that thresholds in these important sectors will advance our climate objectives, streamline project review, and encourage consistency and uniformity in the CEQA analysis of GHG emissions throughout the State.

Staff intends to make its final recommendations on thresholds in early 2009, in order to harmonize with OPR's timeline for issuing draft CEQA guidelines addressing GHG emissions[7] and to provide much needed guidance to lead agencies in the near term.

Public, stakeholder, and local lead agency participation is essential to the success of this project. ARB staff believes that the comment and feedback it receives, along with

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[1] Senate Bill 97, Public Resources Code, § 21083.05.
[2] California Code of Regulations, tit. 14, § 15064, subd. (f)(1).
[3] Id., § 15021, subd. (a)(2).
[4] See: http://opr.ca.gov/download.php?dl=ceqa/pdfs/june08-ceqa.pdf
[5] Id., § 15064.7, subd. (a).
[6] The collective greenhouse gas emissions from the industrial, residential and commercial sectors, together with the transportation sector, represent approximately 80% of the statewide greenhouse gas emissions inventory in 2004.
[7] See Senate Bill 97, Public Resources Code § 21083.05 (providing that draft guidelines are due June 1, 2009).

additional data and analyses, can form a body of evidence that lead agencies may rely on in adopting thresholds of significance consistent with ARB staff's recommendations.

Because the schedule is expedited, staff's recommendations must necessarily be interim and subject to review and revision as more information becomes available.[8]

BACKGROUND

Significance Under CEQA

A significant effect on the environment means a substantial, or potentially substantial, change in the environment caused directly or indirectly by the project.[9] The incremental effect of a project can be significant when it is cumulatively considerable – that is, when the effect is added to that of other past, present, and reasonably foreseeable probable future projects that also contribute to the problem.[10]

To streamline and facilitate consistency in the significance determination, the CEQA Guidelines[11] encourage agencies "to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects."[12] A threshold of significance is an identifiable quantitative, qualitative or performance level that marks the division between an impact that is significant and one that is not. A threshold of significance gives rise to a presumption, which can be rebutted by evidence that the threshold should not apply to a particular project.

Thresholds of significance must be supported by "substantial evidence." This does not mean that there is one best threshold. In CEQA, substantial evidence "means enough relevant information and reasonable inferences from this information that a fair argument can be made to support a conclusion, even though other conclusions might also be reached."[13]

Climate Change and GHG Thresholds of Significance

"The capacity of the environment is limited, and it is the intent of the Legislature that the government of the state take immediate steps to identify any critical thresholds for the health and safety of the people of the state and take all coordinated actions necessary to prevent such thresholds being reached."[14] But where should a threshold of significance be set for GHG emissions and climate change? This question can be answered only after considering the nature of the environmental problem.

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[8] ARB staff intends to monitor the implementation of thresholds that are adopted as a result of this process for effectiveness. In the same time frame as the update of the AB 32 Scoping Plan, staff intends to revisit its recommendations and to modify them if necessary.
[9] California Code of Regulations, title 14, §§ 15064, subd. (d), 15382.
[10] *Id.*, § 15355, subd. (b).
[11] Id., § 15000, et. seq.
[12] *Id.*, § 15064.7, subd. (a).
[13] *Id.*, § 15384, subd. (a).
[14] Public Resources Code, § 21000, subd. (d).

There is a scientific consensus that human activities, chief among them the burning of fossil fuels, profoundly affect the world's climate by increasing the atmospheric concentration of GHG beyond natural levels. Contributing additional GHG pollution to the atmosphere leads to higher global average temperatures, changes to climate, and adverse environmental impacts here in California and around the world.[15] Climate change, caused by "collectively significant projects taking place over a period of time[,]"[16] is a quintessential cumulative impact.

The experts tell us that an additional increase in global average temperatures of just 2 degrees Celsius (3.6 degrees Fahrenheit) is very likely dangerous.[17] With a 2 degree Celsius increase, disastrous effects become likely, including more extreme and more frequent severe weather, more wildfires, greater frequency of droughts and floods, rapid and higher sea level rise, and increased habitat destruction and extinctions.[18] These environmental effects will undoubtedly lead to serious economic, political, and national security disruptions.

In order to reduce the risk of dangerous climate change, we must stabilize atmospheric levels of GHGes at approximately 450 parts per million (ppm) by mid-century.[19] We are fast approaching this limit. Since the beginning of the industrial era, atmospheric concentrations of carbon dioxide, the primary GHG, have climbed to their highest point in the last half-million years, increasing from just under 300 ppm at the turn of the last century, to over 380 ppm today, and rising at about 2 ppm per year.[20]

In response to the challenge of climate change, California has taken a leadership role by committing to reduce its GHG emissions to 1990 levels by 2020 (about a thirty percent reduction in business-as-usual emissions in 2020) and to eighty percent below 1990 levels by 2050.[21] The latter target is consistent with the scientific consensus of the reductions needed to stabilize atmospheric levels of GHGs at 450 ppm by mid-century. Assembly Bill 32, the Global Warming Solutions Act of 2006, codifies the 2020 reduction

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[15] There is a large body of authoritative sources on the causes and current and projected impacts of climate change. An extended discussion of climate change is beyond the scope of this Staff Proposal. For additional information, ARB recommends the Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC) and, in particular, the IPCC's "Frequently Asked Questions," available at: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-faqs.pdf and the 2006 California Climate Action Team's Report to the Governor and Legislature, available at: http://www.climatechange.ca.gov/climate_action_team/reports/index.html.

[16] See California Code of Regulations, tit. 14, § 15355, subd. (b).

[17] See IPCC 4th Assessment Report, Working Group II, Summary for Policymakers, Figure 2, available at: http://www.ipcc.ch/graphics/graphics/ar4-wg2/jpg/spm2.jpg (chart showing global impacts at various temperature increases); California Climate Change Center, Our Changing Climate: Assessing the Risks to California (2008) at p. 15, available at http://www.energy.ca.gov/2006publications/CEC-500-2006-077/CEC-500-2006-077.PDF (chart showing impacts in California at various temperature increases.)

[18] *Id.*

[19] See IPCC 4th Assessment Report, Working Group III, Summary for Policymakers at p. 17, available at http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-spm.pdf.

[20] IPPC 4th Assessment Report, Working Group I, Figure FAQ 2.1, available at: http://www.ipcc.ch/graphics/graphics/ar4-wg1/jpg/faq-2-1-fig-1.jpg.

[21] Executive Order S-03-05

target and charges ARB with development of a Scoping Plan to map out how the State will achieve this target, including regulatory, voluntary, and market-based mechanisms beginning in 2012.[22]

There is strong need, however, to aggressively address GHG emissions right now. The pollution we contribute to the atmosphere today will continue to have climate impacts for years, decades, and, in some cases, millennia to come. And the longer we delay in addressing the problem, the more we risk being unable to meet our climate objective. CEQA provides a mechanism that is independent of AB 32 through which lead agencies can begin immediately to reduce the climate change-related impacts of the projects that come before them.

What Type of Threshold is Appropriate?

Some have suggested that because of the need for urgent action and the uncertainty of the precise "tipping point" for dangerous climate change, any contribution of GHGs to the atmosphere may be significant – a so-called "zero threshold."

ARB staff believes that for the project types under consideration, non-zero thresholds can be supported by substantial evidence. ARB staff believes that zero thresholds are not mandated in light of the fact that (1) some level of emissions in the near term and at mid-century is still consistent with climate stabilization and (2) current and anticipated regulations and programs apart from CEQA (e.g., AB 32, the Pavley vehicle regulations, the Renewable Portfolio Standard, the California Solar Initiative, and the commitment to net-zero-energy buildings by 2020 (residential) and 2030 (commercial)) will proliferate and increasingly will reduce the GHG contributions of past, present, and future projects.

But any non-zero threshold must be sufficiently stringent to make substantial contributions to reducing the State's GHG emissions peak, to causing that peak to occur sooner, and to putting California on track to meet its interim (2020) and long-term (2050) emissions reduction targets. ARB staff believes that the preliminary interim approaches outlined in this Staff Proposal are consistent with these objectives.

RECOMMENDED THRESHOLDS – CONCEPTUAL APPROACH

ARB staff believes that different GHG thresholds of significance may apply to projects in different sectors. Two primary reasons that sector-specific thresholds are appropriate are: (1) some sectors contribute more substantially to the problem, and therefore should have a greater obligation for emissions reductions, and, (2) looking forward, there are differing levels of emissions reductions expected from different sectors in order to meet California's climate objectives. We also believe that different types of thresholds – quantitative, qualitative, and performance-based – can apply to different sectors under the premise that the sectors can and must be treated separately given the state of the science and data. A sector-specific approach is consistent with ARB's

[22] Health and Safety Code, § 38500, et. seq.

Proposed Scoping Plan. Consequently, the Staff Proposal takes different, although harmonious, approaches to setting thresholds for different sectors.

The attached flowcharts describe ARB staff's preliminary interim threshold concepts for two important sectors: industrial projects (**Attachment A**) and residential and commercial projects (**Attachment B**). The objective is to develop thresholds for projects in these sectors that will result in a substantial portion of the GHG emissions from new projects being subject to CEQA's mitigation requirement, consistent with a lead agency's obligation to "avoid or minimize environmental damage where feasible."[23] ARB staff is working on a proposal for an interim approach for thresholds for transportation projects and large dairies. Electricity generation is another sector where clarity is needed in the near term. The California Energy Commission (CEC) recently began a public process for identifying an approach for assessing the significance of GHG emissions from power plant projects. CEC staff anticipates concluding that work in Spring 2009.[24]

ARB staff's proposed recommendations for GHG thresholds address projects for which local agencies are typically the CEQA lead agency. In addition to the CEC, other State agencies also serve as lead agencies under CEQA. ARB is coordinating with these State agencies on their approaches to thresholds of significance.

[23] California Code of Regulations, title 14, § 15021.
[24] The CEC adopted an Order Instituting Informational Proceeding on October 8, 2008 to address GHG emissions in power plant licensing cases: http://www.energy.ca.gov/ghg_powerplants/notices/2008-10-06_PROPOSED_GHG_CEQA_OII.PDF.

REQUEST FOR PUBLIC COMMENT

ARB staff believes that the concepts in this Staff Proposal can be further developed into interim thresholds of significance. However, staff recognizes that additional analyses and data are needed to fill in some of the blanks, and to understand how the thresholds will operate in the real world.

Comments on all aspects of the Staff Proposal are encouraged. In particular, ARB seeks the active participation of local lead agencies. Staff has identified a few questions to solicit public comment, but this list is not exhaustive.

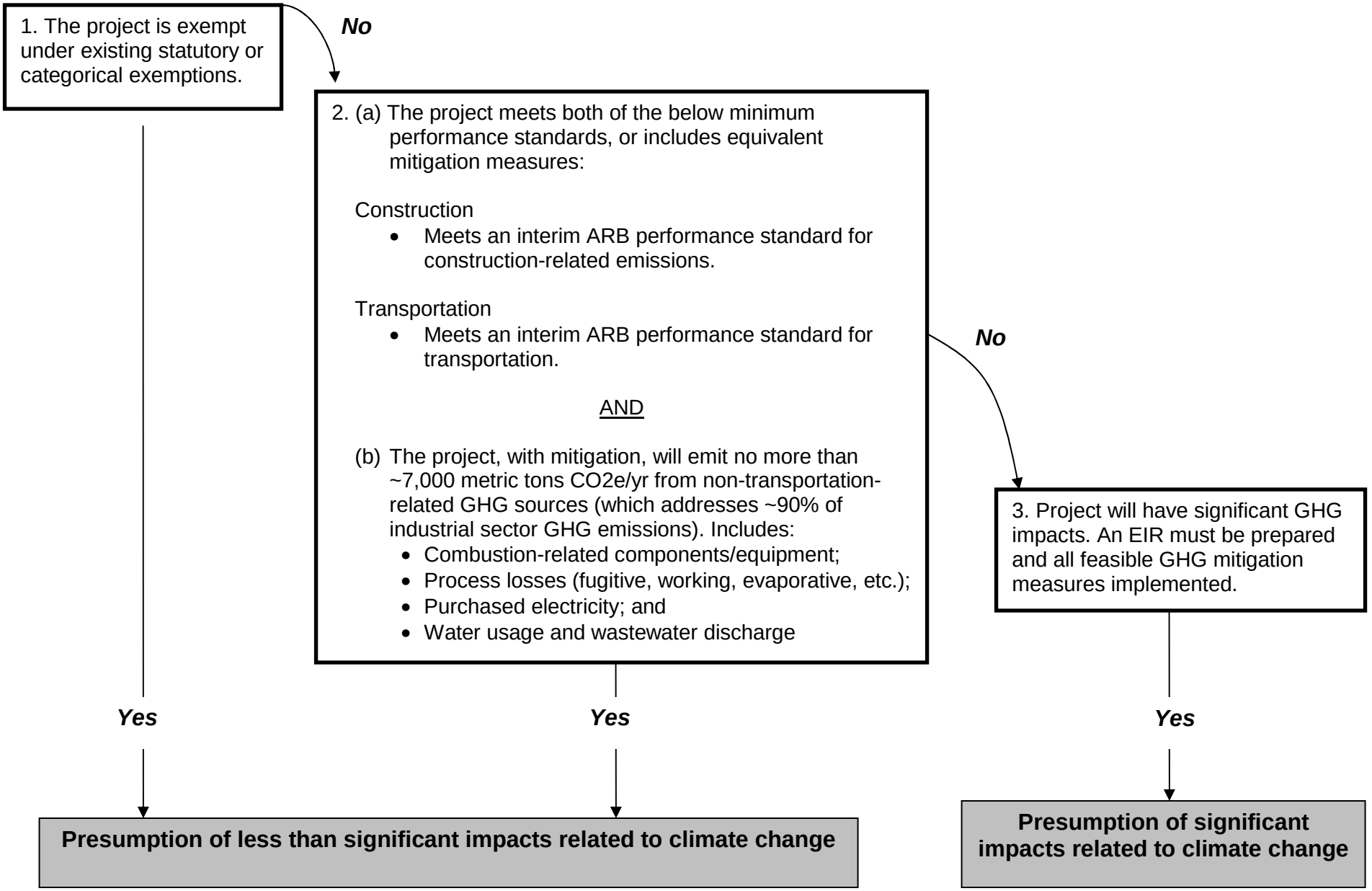
- Will the recommended approaches have any unintended consequences, for example, encouraging the piecemealing of projects?

- As set out in the attachments to the Staff Proposal, staff proposes to define certain performance standards (*e.g.*, for energy efficiency) by referencing or compiling lists from existing local, State or national standards. For some sub-sources of GHG emissions (*e.g.*, construction, transportation, waste), ARB staff has not identified reference standards. How should the performance standards for these sub-sources be defined?

- Are any of the industrial, residential, or commercial project types eligible for categorical exemptions likely to contribute more significantly to climate change than staff's preliminary analysis indicates?

- For residential and commercial projects, staff has proposed that the GHG emissions of some projects that meet GHG performance standards might under some circumstances still be considered cumulatively considerable and therefore significant. What types of projects might still have significant climate change-related impacts?

ATTACHMENT A
Preliminary Draft Proposal for Industrial Projects



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Preliminary Draft Proposal for Industrial Projects

Introduction

CEQA guidelines provide that thresholds of significance can be qualitative, quantitative, or in the form of performance standards. ARB staff's objective is to develop a threshold of significance that will result in the vast majority (~90% statewide) of the greenhouse gas (GHG) emissions from new industrial projects being subject to CEQA's requirement to impose feasible mitigation. ARB staff believes this can be accomplished with a threshold that allows small projects to be considered insignificant. ARB staff used existing data for the industrial sector to derive a proposed hybrid threshold. The threshold consists of a quantitative threshold of 7,000 metric tons of CO2 equivalent per year (MTCO2e/year) for operational emissions (excluding transportation), and performance standards for construction and transportation emissions.

The goal of this effort is to provide for the mitigation of GHG emissions from industrial projects on a statewide level. Over time, implementation of AB 32 will reduce or mitigate GHG emissions from industrial sources. Once such requirements are in place, they could become the performance standard for industrial projects for CEQA purposes. ARB staff intends to pursue this approach in conjunction with development of the regulatory requirements for industrial sources in the Proposed AB 32 Scoping Plan. Staff is proposing the use of a quantitative significance threshold at least until such time that performance standards, such AB 32 regulatory requirements, are in place to ensure mitigation of significant impacts of GHG emissions from projects in the industrial sector.

The performance standards are largely self explanatory and similar to the approaches proposed for residential and commercial projects. The method for deriving the quantitative aspect of the threshold warrants further explanation.

Technical foundation for proposed quantitative aspect of the threshold

Based on the available data, ARB staff found that for the industrial sector, small projects – defined as the portion of new projects that, when viewed collectively, were responsible for only a relatively small amount of emissions – could be allowed to proceed without requiring additional mitigation under CEQA. The question for ARB staff was what line divides these small projects from the rest of the projects that should undergo mitigation to achieve the larger environmental objective.

ARB decided to construct a representative small project and to estimate that project's expected emissions. First, ARB considered the common sub-sources of GHG emissions in the industrial sector. The four main broad emission categories and their approximate statewide contribution to GHG emissions from industrial facilities other than power plants are:

Category	MMTCO2e/year	Percent (%)
Combustion processes	70	63 %
Process Losses (evaporative, fugitive, working, etc.)	15	13 %
Purchased Electricity	18	17 %
Water Use and Wastewater Treatment	7	7 %

As the table indicates, GHG emissions from industrial sources are dominated by combustion emissions. To ensure that significant industrial emissions would be captured by the proposed threshold, ARB staff evaluated industrial boilers because they are a very common piece of equipment, are essential in many energy-intensive industries, and are a top contributor to industrial combustion emissions.

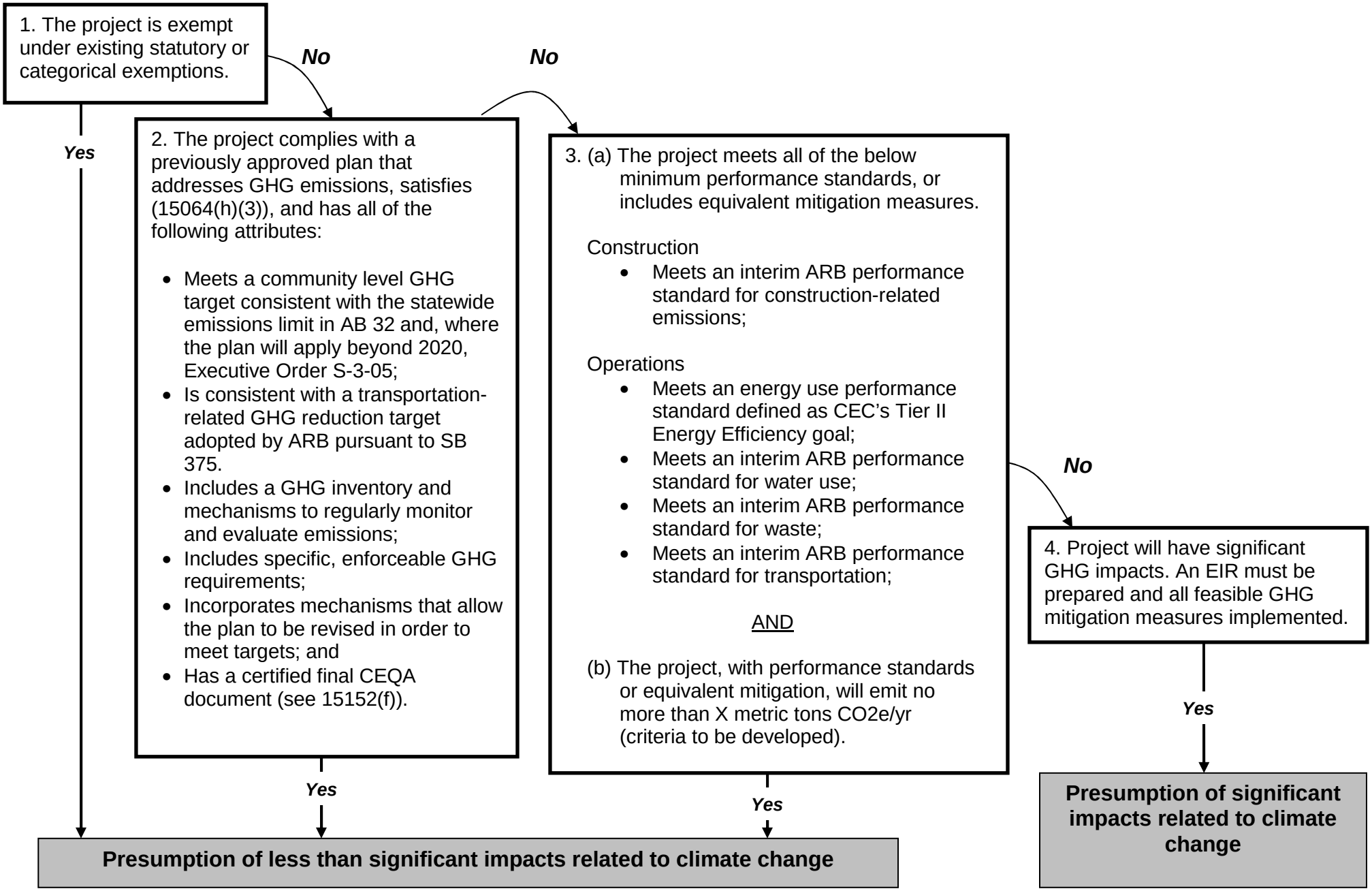
A recent comprehensive survey of industrial boilers by Oak Ridge National Laboratory[25] found that boilers with an input capacity of 10 MMBtu/hr or greater correspond to 93 percent of total industrial boiler input capacity. Based on this data, ARB staff used a natural gas boiler input capacity benchmark of 10 MMBtu/hr which equates to emissions of 4,660 MTCO2e/yr. This capacity benchmark defines a significant combustion source.

As shown in the above table, combustion processes account for 63 percent of the statewide GHG emissions from industrial facilities. Process losses, purchased electricity, and water use and water treatment account for the remaining 27 percent of emissions. Staff applied these proportions to the benchmark combustion emissions estimate (4,660 MTCO2e/yr). The result is an overall emissions estimate of approximately 7,000 MTCO2e/yr for a representative small project that accounts for the four main categories in the table above.

Based on the available data, staff believes that the 7,000 MTCO2e/year benchmark can be used to effectively mitigate industrial projects with significant GHG emissions.

[25] Characterization of the U.S. Industrial/Commercial Boiler Population, Energy, and Environmental Analysis, Inc. submitted to Oak Ridge National Laboratory, available at:: http://ww.eea-inc.com/natgas_reports/BoilersFinal.pdf.

ATTACHMENT B
Preliminary Draft Proposal for Residential and Commercial Projects



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Preliminary Draft Proposal for Residential and Commercial Projects

Introduction

CEQA guidelines provide that thresholds of significance can be qualitative, quantitative, or in the form of performance standards. ARB staff's objective is to develop a threshold for residential and commercial projects that will substantially reduce the greenhouse gas (GHG) emissions from new projects and streamline the permitting of carbon-efficient projects. To achieve this, staff's preliminary recommendation is to develop a threshold based on clear and stringent performance standards.

Performance standards will address the five major emission sub-sources for the sector: energy use, transportation, water use, waste, and construction. For the energy use performance standard, staff recommends reliance on the California Energy Commission's (CEC) Tier II Energy Efficiency standards for solar energy incentive programs. These standards are consistent with what is needed to meet the state's goal of zero net energy buildings and are continuously updated to reflect energy efficiency best practices. For the remaining sub-sources (water, waste, etc.), staff intends to compile benchmark performance standards as part of its final threshold recommendation. Projects may alternatively incorporate mitigation equivalent to these performance standards.

Staff recognizes that a substantial body of measures to address GHG emissions exists through programs like LEED, GreenPoint Rated, and the California Green Building Code. As work on performance standards moves forward, staff intends to make use of these projects.

In addition, staff proposes that a presumption of non-significance apply only to projects whose total net emissions, after meeting the performance standards or equivalent, are below a specified level. Staff proposes to develop this emissions level as part of its final threshold recommendation.

Discussion of Flow Chart

Box 1: In general, categorical exemptions will continue to apply.

Based on its preliminary analysis, ARB staff believes that projects described in CEQA's categorical and statutory exemption provisions (Articles 18 and 19 of the California Code of Regulations, title 14) will not interfere with achieving the objective to minimize emissions from new projects in this sector. GHG emissions from residential and commercial projects that are described in the categorical exemption language appear to be relatively small from a GHG perspective. For example, staff's preliminary analysis indicates that emissions from a project qualifying for the statutory infill project exemption (Cal. Code Regs., tit. 14, § 15195) will emit approximately 1,600 metric tons (MT)CO2e/yr. Staff believes

such infill projects represent some of the largest projects described in the exemption provisions. ARB staff expects to provide additional analyses to support a lead agency's determination that the GHG impact of these project types is less than significant. Staff invites the public and stakeholders to provide further evidence on the application of categorical exemptions to residential and commercial projects.

Box 2: If GHGs are adequately addressed at the programmatic level, the impact of certain individual projects can be found to be insignificant.

As OPR noted in its June 2008 Technical Advisory:

> CEQA can be a more effective tool for greenhouse gas emissions analysis and mitigation if it is supported and supplemented by sound development policies and practices that will reduce greenhouse gas emissions on a broad planning scale and that can provide the basis for a programmatic approach to project-specific CEQA analysis and mitigation…. For local government lead agencies, adoption of general plan policies and certification of general plan EIRs that analyze broad jurisdiction-wide impacts of greenhouse gas emissions can be part of an effective strategy for addressing cumulative impacts and for streamlining later project-specific CEQA reviews.

ARB staff encourages local agencies to take advantage of a programmatic approach to address climate change, consistent with existing law.

If a project complies with the requirements of a previously adopted GHG emission reduction plan or mitigation program that satisfies California Code of Regulations, title 14, section 15064(h)(3), and includes the attributes specified in that provision and Box 2, the lead agency may determine that the project's GHG impacts are less than significant with no further analysis required. Examples of plans that may satisfy this provision include Climate Action Plans incorporated into General Plans that have inventories, an emissions target, suites of specific and enforceable measures to reach that target, monitoring and reporting, and mechanisms to revise the plan to stay on target. Moreover, a prior EIR that "adequately addressed" climate change may be used for tiering purposes. (See Cal. Code Regs. tit. 14, § 15152.)

Box 3: Projects that meet performance standards, or include equivalent mitigation, can be found to be insignificant.

The threshold incorporates performance standards requiring carbon efficiency for each major sub-source of emissions from projects in these sectors. Provided they are set at a sufficiently stringent level, performance standards will dramatically reduce GHG emissions and promote a transition toward zero and low emission projects. In most cases, ARB staff expects that performance

standards will need to reach beyond current State mandates by a substantial amount, given that GHG emission reduction goals have not yet been adequately incorporated into State programs. Staff anticipates that performance standards will become more stringent over time.

ARB staff has identified the California Energy Commission's Tier II Energy Efficiency goals as an appropriate performance standard for energy use. Under State law, the CEC is required to establish eligibility criteria, conditions for incentives, and rating standards to qualify for ratepayer-funded solar energy system incentives in California. As part of this effort, the CEC establishes energy efficiency standards for homes and commercial structures, and requires new buildings to exceed current building standards by meeting Tier Energy Efficiency goals. CEC's Tier II Energy Efficiency goals will continue to be updated to achieve energy efficiency best practices, and are consistent with what is needed to meet the California Public Utilities Commission Strategic Plan goals of zero net energy buildings. Currently, the CEC's proposed guidelines for the solar energy incentive program recommend a Tier II goal for residential and commercial projects of a 30 percent reduction in building combined space heating, cooling, and water heating energy compared to the 2008 Title 24 Standards.[26]

For the remaining sub-sources, staff intends to compile benchmark performance standards as part of its final threshold recommendation. ARB staff believes that existing progressive green building standards provide a starting point for performance standards for transportation, water use, waste, and construction-related emissions. Existing green building rating systems like LEED, GreenPoint Rated, the California Green Building Code, and others, contain examples of measures that are likely to result in substantial GHG emission reductions from residential and commercial projects. The key to this approach will be identifying effective GHG reduction measures within these systems. ARB staff would like input from the public and stakeholders on appropriate performance standards for these sub-sources. Performance standards that already exist and have been proven to be effective – at the local, State, national or international level – are preferable.

Under staff's proposed approach, lead agencies would be allowed to find that a project's mitigation is "equivalent" to identified performance standards, thereby allowing for cost-effective and innovative approaches to reducing GHG emissions.

Staff believes that under some circumstances, projects that meet performance standards or include equivalent mitigation measures will have impacts that may still be cumulatively considerable and therefore significant. For this reason, staff recommends that, in addition to meeting performance standards or including

[26] Guidelines for California's Solar Electric Incentive Program Pursuant to Senate Bill 1 - SECOND EDITION - Draft Guidelines can be found at: http://www.energy.ca.gov/2008publications/CEC-300-2008-007/CEC-300-2008-007-D.PDF

equivalent mitigation measures, a project must also emit no more than “X” MTCO2e/yr. Criteria for determining this emissions level have yet to be defined. ARB requests public and stakeholder input on what types of projects might still have significant climate change-related impacts.

Box 4: Presumption of significant impacts.

If a project cannot meet the requirements in the previous boxes, it should be presumed to have significant impacts related to climate change. The lead agency must then prepare an EIR, or other appropriate document, and implement all feasible GHG mitigation measures.

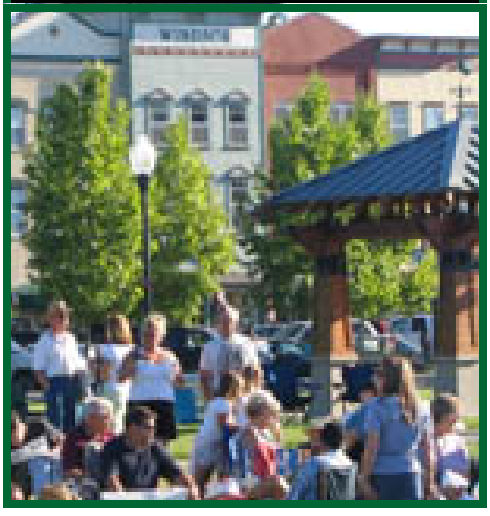
CAPCOA

CALIFORNIA AIR POLLUTION CONTROL OFFICERS ASSOCIATION









CEQA & Climate Change

Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act

January 2008

Disclaimer

The California Air Pollution Control Officers Association (CAPCOA) has prepared this white paper consideration of evaluating and addressing greenhouse gas emissions under the California Environmental Quality Act (CEQA) to provide a common platform of information and tools to support local governments.

This paper is intended as a resource, not a guidance document. It is not intended, and should not be interpreted, to dictate the manner in which an air district or lead agency chooses to address greenhouse gas emissions in the context of its review of projects under CEQA.

This paper has been prepared at a time when California law has been recently amended by the Global Warming Solutions Act of 2006 (AB 32), and the full programmatic implications of this new law are not yet fully understood. There is also pending litigation in various state and federal courts pertaining to the issue of greenhouse gas emissions. Further, there is active federal legislation on the subject of climate change, and international agreements are being negotiated. Many legal and policy questions remain unsettled, including the requirements of CEQA in the context of greenhouse gas emissions. This paper is provided as a resource for local policy and decision makers to enable them to make the best decisions they can in the face of incomplete information during a period of change.

Finally, this white paper reviews requirements and discusses policy options, but it is not intended to provide legal advice and should not be construed as such. Questions of legal interpretation, particularly in the context of CEQA and other laws, or requests for advice should be directed to the agency's legal counsel.

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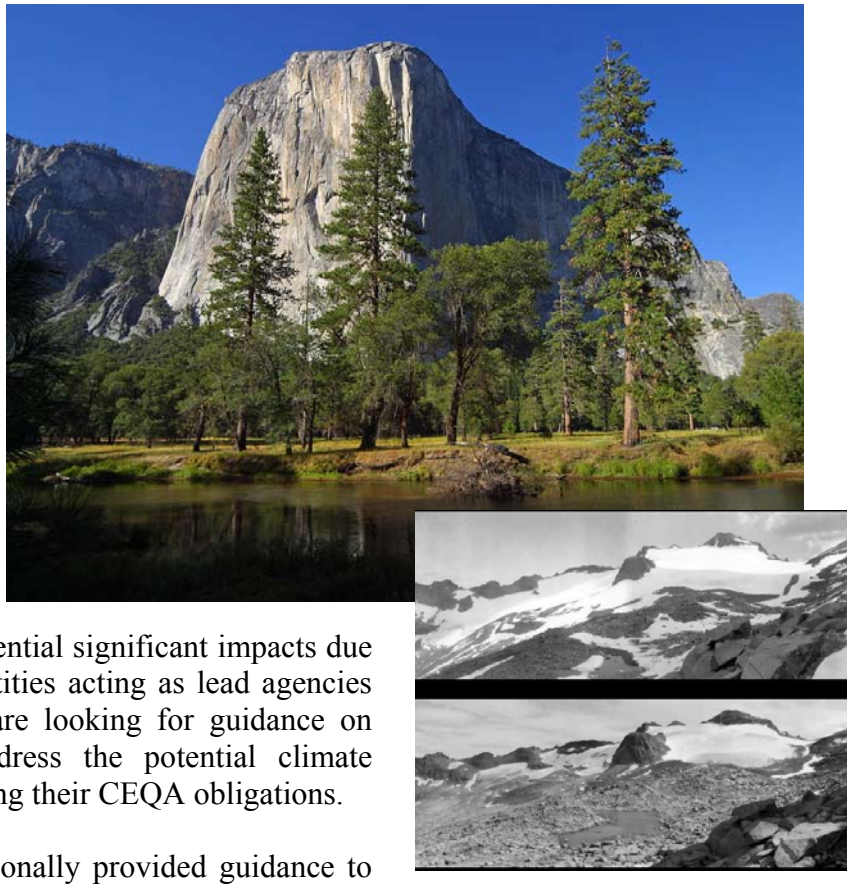
Acronym/ Abbreviation	Meaning
AB 32	Assembly Bill 32 Global Warming Solutions Act of 2006
AG	Attorney General
ARB	Air Resources Board
ASTM	American Society of Testing and Material
BAAQMD	Bay Area Air Quality Management District
BAU	Business as Usual
BEES	Building for Environmental and Economic Sustainability
Calfire	California Fire
Caltrans	California Department of Transportation
CAP	Criteria Air Pollutants
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resource Board
CAT	Climate Action Team
CCAP	Center for Clean Air Policy
CCAR	California Climate Action Registry
CDFA	California Department of Food and Agriculture
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CF	Connectivity Factor
CH_4	Methane
CIWMB	California Integrated Waste Management Board
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CNG	Compressed Natural Gas
CPUC	California Public Utilities Commission
CUFR	California Urban Forestry
DGS	Department of General Services
DOE	U.S. Department of Energy
DOF	Department of Finance
DPF	Diesel Particulate Filter
DWR	Department of Water Resources
E85	85% Ethanol
EEA	Massachusetts Executive Office of Energy and Environmental Affairs
EERE	Energy Efficiency and Renewable Energy
EIR	Environmental Impact Report
EOE	Encyclopedia of Earth
EPA	U.S. Environmental Protection Agency
ETC	Edmonton Trolley Coalition
EV	Electric Vehicles
FAR	Floor Area Ratio

GHG	Greenhouse Gas
GGEP	Greenhouse Gas Emissions Policy
GGRP	Greenhouse Gas Reduction Plan
GP	General Plan
GWP	Global Warming Potential
IGCC	Integrated Gasification Combined Cycle
IOU	Investor Owned Utility
IPCC	International Panel on Climate Change
IT	Information Technology
ITE	Institute of Transportation Engineers
J&S	Jones & Stokes
km	Kilometer
LandGem	Landfill Gas Emissions Model
LEED	Leadership in Energy and Environmental Design
LNG	Liquefied Natural Gas
MBUAPCD	Monterey Bay Unified Air Pollution Control District
MEPA	Massachusetts Environmental Policy Act
MND	Mitigated Negative Declaration
MMT CO_2e	Million Metric Tons Carbon Dioxide Equivalent
MW	Megawatts
N_2O	Nitrous Oxide
NACAA	National Association Clean Air Agencies
ND	Negative Declaration
NEV	Neighborhood Electric Vehicle
NIST	National Institute of Standards and Technology
NO_X	Oxides of Nitrogen
NREL	National Renewable Energy Laboratory
NSCAPCD	Northern Sonoma County Air Pollution Control District
NSR	New Source Review
OPR	State Office of Planning and Research
PFC	Perfluorocarbon
PG&E	Pacific Gas & Electric
POU	Publicly Owned Utility
PM	Particulate Mater
RoadMod	Road Construction Emissions Model
ROG	Reactive Organic Gas
RPS	Renewable Portfolio Standards
RTP	Regional Transportation Plan
S-3-05	Executive Order S-3-05
SB	Senate Bill
SBCAPCD	Santa Barbara County Air Pollution Control District
SCAQMD	South Coast Air Quality Management District
SCM	Sustainable Communities Model
SIP	State Implementation Plan
SJVAPCD	San Joaquin Valley Unified Air Pollution Control District
SLOCAPCD	San Luis Obispo County Air Pollution Control District

SMAQMD	Sacramento Metropolitan Air Quality Management District
SMUD	Sacramento Municipal Utilities District
SO_X	Sulfur Oxides
SP	Service Population
SRI	Solar Reflectance Index
SWP	State Water Project
TAC	Toxic Air Contaminants
TBD	To Be Determined
TDM	Transportation Demand Management
TMA	Transportation Management Association
THC	Total Hydrocarbon
UC	University of California
ULEV	Ultra Low Emission Vehicle
UNFCCC	United Nations Framework Convention on Climate Change
URBEMIS	Urban Emissions Model
USGBC	U.S. Green Building Council
VMT	Vehicle Miles Traveled
VTPI	Victoria Transit Policy
YSAQMD	Yolo-Solano Air Quality Management District

Introduction

The California Environmental Quality Act (CEQA) requires that public agencies refrain from approving projects with significant adverse environmental impacts if there are feasible alternatives or mitigation measures that can substantially reduce or avoid those impacts. There is growing concern about greenhouse gas emissions[1] (GHG) and recognition of their significant adverse impacts on the world's climate and on our environment. In its most recent reports, the International Panel on Climate Change (IPCC) has called the evidence for this "unequivocal." In California, the passage of the Global Warming Solutions Act of 2006 (AB 32) recognizes the serious threat to the "economic well-being, public health, natural resources, and the environment of California" resulting from global warming. In light of our current understanding of these impacts, public agencies approving projects subject to the CEQA are facing increasing pressure to identify and address potential significant impacts due to GHG emissions. Entities acting as lead agencies in the CEQA process are looking for guidance on how to adequately address the potential climate change impacts in meeting their CEQA obligations.



Air districts have traditionally provided guidance to local lead agencies on evaluating and addressing air pollution impacts from projects subject to CEQA. Recognizing the need for a common platform of information and tools to support decision makers as they establish policies and programs for GHG and CEQA, the California Air Pollution Control Officers Association has prepared a white paper reviewing policy choices, analytical tools, and mitigation strategies.

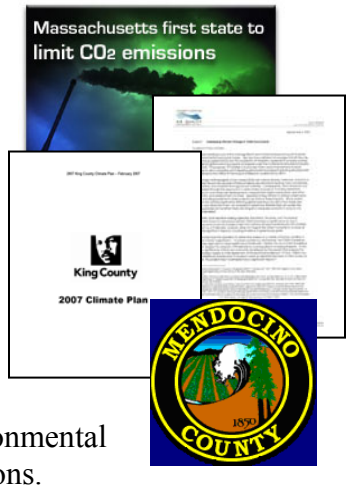
This paper is intended to serve as a resource for public agencies as they establish agency procedures for reviewing GHG emissions from projects under CEQA. It considers the application of thresholds and offers three alternative programmatic approaches toward

[1] Throughout this paper GHG, CO_2, CO_2e, are used interchangeably and refer generally to greenhouse gases but do not necessarily include all greenhouse gases unless otherwise specified.

determining whether GHG emissions are significant. The paper also evaluates tools and methodologies for estimating impacts, and summarizes mitigation measures. It has been prepared with the understanding that the programs, regulations, policies, and procedures established by the California Air Resources Board (CARB) and other agencies to reduce GHG emissions may ultimately result in a different approach under CEQA than the strategies considered here. The paper is intended to provide a common platform for public agencies to ensure that GHG emissions are appropriately considered and addressed under CEQA while those programs are being developed.

Examples of Other Approaches

Many states, counties, and cities have developed policies and regulations concerning greenhouse gas emissions that seek to require or promote reductions in GHG emissions through standards for vehicle emissions, fuels, electricity production/renewables, building efficiency, and other means. A few have developed guidance and are currently considering formally requiring or recommending the analysis of greenhouse gas emissions for development projects during their associated environmental processes. Key work in this area includes:



- Massachusetts Office of Energy and Environmental Affairs Greenhouse Gas Emissions Policy;
- King County, Washington, Executive Order on the Evaluation of Climate Change Impacts through the State Environmental Policy Act;
- Sacramento AQMD interim policy on addressing climate change in CEQA documents; and
- Mendocino AQMD updated guidelines for use during preparation of air quality impacts in Environmental Impact Reports (EIRs) or mitigated negative declarations.

The following paper evaluates options for lead agencies to ensure that GHG emissions are appropriately addressed as part of analyses under CEQA. It considers the use of significance thresholds, tools and methodologies for analyzing GHG emissions, and measures and strategies to avoid, reduce, or mitigate impacts.

Greenhouse Gas Significance Criteria

This white paper discusses three basic options air districts and lead agencies can pursue when contemplating the issues of CEQA thresholds for greenhouse gas emissions. This paper explores each path and discusses the benefits and disbenefits of each. The three basic paths are:

- No significance threshold for GHG emissions;

- GHG emissions threshold set at zero; or
- GHG threshold set at a non-zero level.

Each has inherent advantages and disadvantages. Air districts and lead agencies may believe the state or national government should take the lead in identifying significance thresholds to address this global impact. Alternatively, the agency may believe it is premature or speculative to determine a clear level at which a threshold should be set. On the other hand, air districts or lead agencies may believe that every GHG emission should be scrutinized and mitigated or offset due to the cumulative nature of this impact. Setting the threshold at zero will place all discretionary projects under the CEQA microscope. Finally, an air district or lead agency may believe that some projects will not benefit from a full environmental impact report (EIR), and may believe a threshold at some level above zero is needed.

This paper explores the basis and implications of setting no threshold, setting a threshold at zero and two primary approaches for those who may choose to consider a non-zero threshold. The first approach is grounded in statute (AB 32) and executive order (EO S-3-05) and explores four possible options under this scenario. The options under this approach are variations of ways to achieve the 2020 goals of AB 32 from new development, which is estimated to be about a 30 percent reduction from business as usual.

The second approach explores a tiered threshold option. Within this option, seven variations are discussed. The concepts explored here offer both quantitative and qualitative approaches to setting a threshold as well as different metrics by which tier cut-points can be set. Variations range from setting the first tier cut-point at zero to second-tier cut-points set at defined emission levels or based on the size of a project. It should be noted that some applications of the tiered threshold approach may require inclusion in a General Plan or adoption of enabling regulations or ordinances to render them fully effective and enforceable.

Greenhouse Gas Analytical Methodologies

The white paper evaluates various analytical methods and modeling tools that can be applied to estimate the greenhouse gas emissions from different project types subject to CEQA. In addition, the suitability of the methods and tools to characterize accurately a project's emissions is discussed and the paper provides recommendations for the most appropriate methodologies and tools currently available.

The suggested methodologies are applied to residential, commercial, specific plan and general plan scenarios where GHG emissions are estimated for each example. This chapter also discusses estimating emissions from solid waste facilities, a wastewater treatment plant, construction, and air district rules and plans.

Another methodology, a service population metric, that would measure a project's overall GHG efficiency to determine if a project is more efficient than the existing statewide average for per capita GHG emissions is explored. This methodology may be more directly correlated to a project's ability to help achieve objectives outlined in AB 32, although it relies on establishment of an efficiency-based significance threshold. The subcommittee believes this methodology may eventually be appropriate to evaluate the long-term GHG emissions from a project in the context of meeting AB 32 goals. However, this methodology will need further work and is not considered viable for the interim guidance presented in this white paper.

Greenhouse Gas Mitigation Measures

Common practice in environmental protection is first to avoid, then to minimize, and finally to compensate for impacts. When an impact cannot be mitigated on-site, off-site mitigation can be effectively implemented in several resource areas, either in the form of offsetting the same impact or preserving the resource elsewhere in the region.

This white paper describes and evaluates currently available mitigation measures based on their economic, technological and logistical feasibility, and emission reduction effectiveness. The potential for secondary impacts to air quality are also identified for each measure. A summary of current rules and regulations affecting greenhouse gas emissions and climate change is also provided.





Reductions from transportation related measures (e.g., bicycle, pedestrian, transit, and parking) are explored as a single comprehensive approach to land use. Design measures that focus on enhancing alternative transportation are discussed. Mitigation measures are identified for transportation, land use/building design, mixed-use development, energy efficiency, education/social awareness and construction.

Purpose

CEQA requires the avoidance or mitigation of significant adverse environmental impacts where there are feasible alternatives available. The contribution of GHG to climate change has been documented in the scientific community. The California Global Warming Solutions Act of 2006 (AB 32) mandates significant reductions in greenhouse gases (GHG); passage of that law has highlighted the need to consider the impacts of GHG emissions from projects that fall under the jurisdiction of the California Environmental Quality Act (CEQA). Because we have only recently come to fully recognize the potential for significant environmental impacts from GHG, most public agencies have not yet established policies and procedures to consider them under CEQA. As a result, there is great need for information and other resources to assist public agencies as they develop their programs.

Air districts have historically provided guidance to local governments on the evaluation of air pollutants under CEQA. As local concern about climate change and GHG has increased, local governments have requested guidance on incorporating analysis of these impacts into local CEQA review. The California Air Pollution Control Officers Association (CAPCOA), in coordination with the CARB, the Governor's Office of Planning and Research (OPR) and two environmental consulting firms, has harnessed the collective expertise to evaluate approaches to analyzing GHG in CEQA. The purpose of this white paper is to provide a common platform of information and tools to address climate change in CEQA analyses, including the evaluation and mitigation of GHG emissions from proposed projects and identifying significance threshold options.

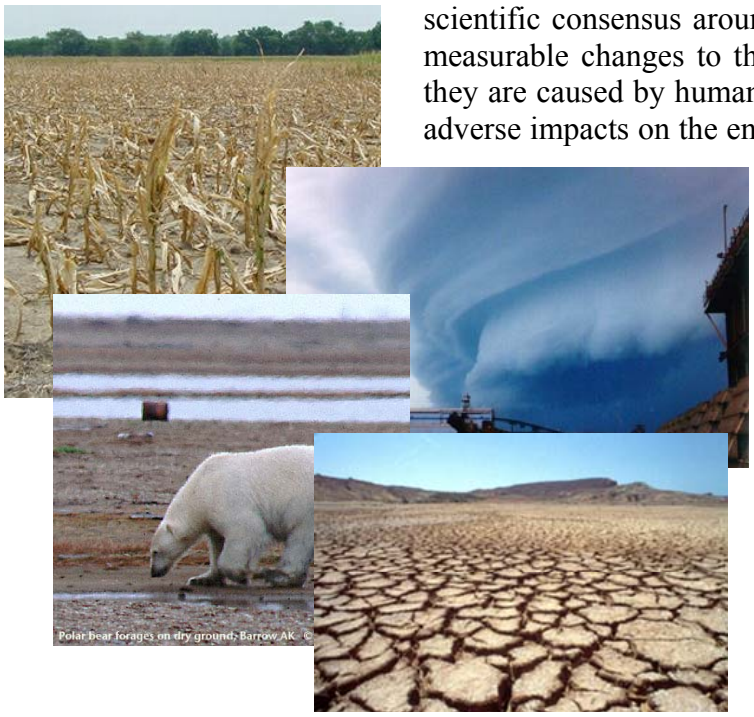


CEQA requires public agencies to ensure that potentially significant adverse environmental effects of discretionary projects are fully characterized, and avoided or mitigated where there are feasible alternatives to do so. Lead agencies have struggled with how best to identify and characterize the magnitude of the adverse effects that individual projects have on the global-scale phenomenon of climate change, even more so since Governor Schwarzenegger signed Executive Order S-3-05 and the state Legislature enacted The Global Warming Solutions Act of 2006 (AB 32). There is now a resounding call to establish procedures to analyze and mitigate greenhouse gas (GHG) emissions. The lack of established thresholds does not relieve lead agencies of their responsibility to analyze and mitigate significant impacts, so many of these agencies are seeking guidance from state and local air quality agencies. This white paper addresses issues inherent in establishing CEQA thresholds, evaluates tools, catalogues mitigation measures and provides air districts and lead agencies with options for incorporating climate change into their programs.

Background

National and International Efforts

International and Federal legislation have been enacted to deal with climate change issues. The Montreal Protocol was originally signed in 1987 and substantially amended in 1990 and 1992. In 1988, the United Nations and the World Meteorological Organization established the IPCC to assess the scientific, technical and socioeconomic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts, and options for adaptation and mitigation. The most recent reports of the IPCC have emphasized the scientific consensus around the evidence that real and measurable changes to the climate are occurring, that they are caused by human activity, and that significant adverse impacts on the environment, the economy, and human health and welfare are unavoidable.



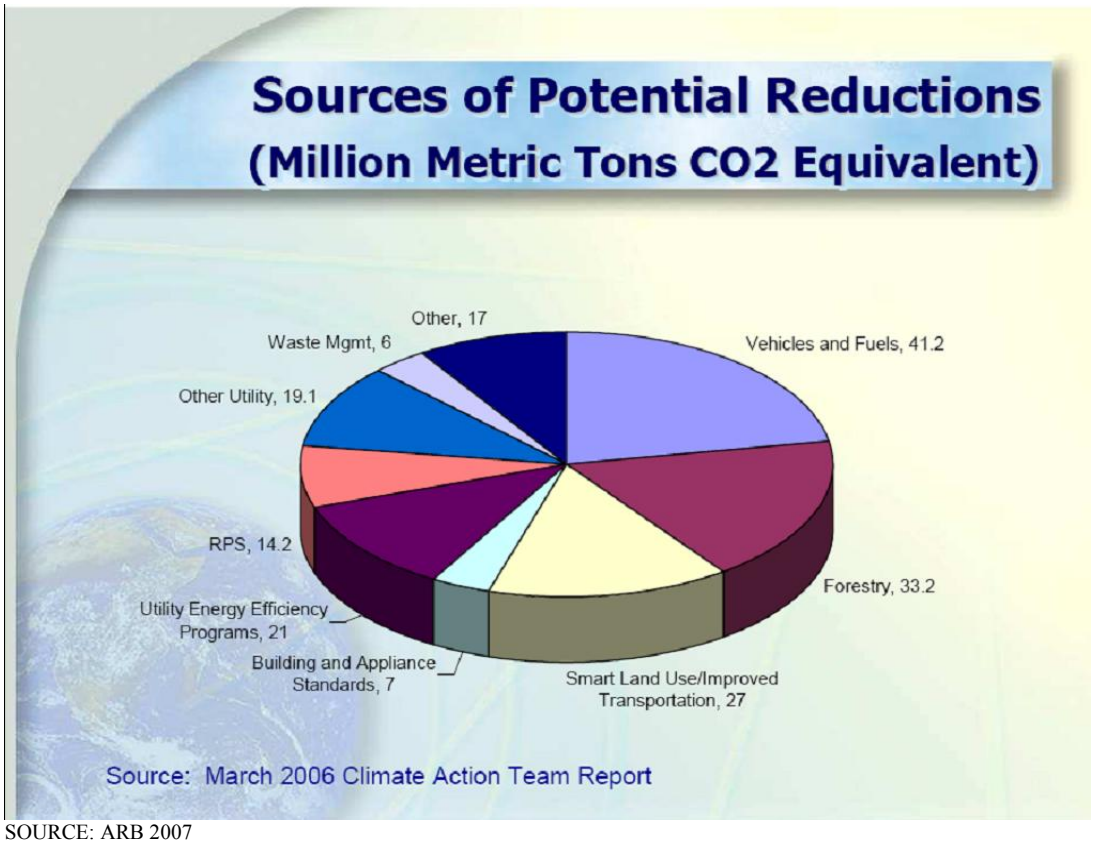
In October 1993, President Clinton announced his Climate Change Action Plan, which had a goal to return greenhouse gas emissions to 1990 levels by the year 2000. This was to be accomplished through 50 initiatives that relied on innovative voluntary partnerships between the private sector and government aimed at producing cost-effective reductions in greenhouse gas emissions. On March 21, 1994, the United States joined a number of countries around the world in signing the United Nations Framework Convention on Climate Change (UNFCCC). Under the Convention, governments agreed to gather and share information on greenhouse gas emissions, national policies, and best practices; launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; and cooperate in preparing for adaptation to the impacts of climate change.

These efforts have been largely policy oriented. In addition to the national and international efforts described above, many local jurisdictions have adopted climate change policies and programs. However, thus far little has been done to assess the significance of the affects new development projects may have on climate change.

Executive Order S-3-05

On June 1, 2005, Governor Schwarzenegger issued Executive Order S-3-05 (S-3-05). It included the following GHG emission reduction targets: by 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; by 2050, reduce GHG emissions to 80 percent below 1990 levels. To meet the targets, the Governor directed the Secretary of the California Environmental Protection Agency to coordinate with the Secretary of the Business, Transportation and Housing Agency, Secretary of the Department of Food and Agriculture, Secretary of the Resources Agency, Chairperson of the CARB, Chairperson of the Energy Commission and President of the Public Utilities Commission on development of a Climate Action Plan.

The Secretary of CalEPA leads a Climate Action Team (CAT) made up of representatives from the agencies listed above to implement global warming emission reduction programs identified in the Climate Action Plan and report on the progress made toward meeting the statewide greenhouse gas targets that were established in the Executive Order.



SOURCE: ARB 2007

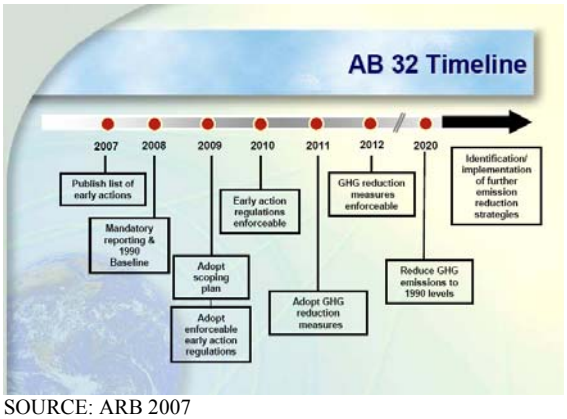
In accord with the requirements of the Executive Order, the first report to the Governor and the Legislature was released in March 2006 and will be issued bi-annually thereafter. The CAT Report to the Governor contains recommendations and strategies to help ensure the targets in Executive Order S-3-05 are met.

California Global Warming Solutions Act of 2006 (AB 32)

In 2006, the California State Legislature adopted the California Global Warming Solutions Act of 2006. AB 32 establishes a cap on statewide greenhouse gas emissions and sets forth the regulatory framework to achieve the corresponding reduction in statewide emissions levels. AB 32 charges the California Air Resources Board (CARB), the state agency charged with regulating statewide air quality, with implementation of the act. Under AB 32, greenhouse gases are defined as: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

The regulatory steps laid out in AB 32 require CARB to: adopt early action measures to reduce GHGs; to establish a statewide greenhouse gas emissions cap for 2020 based on 1990 emissions; to adopt mandatory reporting rules for significant source of greenhouse gases; and to adopt a scoping plan indicating how emission reductions will be achieved via regulations, market mechanisms and other actions; and to adopt the regulations needed to achieve the maximum technologically feasible and cost-effective reductions in greenhouse gases.

AB 32 requires that by January 1, 2008, the State Board shall determine what the statewide greenhouse gas emissions inventory was in 1990, and approve a statewide greenhouse gas emissions limit that is equivalent to that level, to be achieved by 2020. While the level of 1990 GHG emissions has not yet been approved, CARB's most recent emission inventory indicates that California had annual emissions of 436 million metric tons of carbon dioxide equivalent (MMT CO_2e) in 1990 and 497 MMT CO_2e in 2004.



SOURCE: ARB 2007

The regulatory timeline laid out in AB 32 requires that by July 1, 2007, CARB adopt a list of discrete early action measures, or regulations, to be adopted and implemented by January 1, 2010. These actions will form part of the State's comprehensive plan for achieving greenhouse gas emission reductions. In June 2007, CARB adopted three discrete early action measures. These three new proposed regulations meet the definition of "discrete early action greenhouse gas reduction measures," which include the following: a low carbon fuel standard; reduction of HFC-134a emissions from non-professional servicing of motor vehicle air conditioning systems; and improved landfill methane capture. CARB estimates that by 2020, the reductions from those three discrete early action measures would be approximately 13-26 MMT CO_2e.

CARB evaluated over 100 possible measures identified by the CAT for inclusion in the list of discrete early action measures. On October 25, 2007 CARB gave final approval to the list of Early Action Measures, which includes nine discrete measures and 35

additional measures, all of which are to be enforceable by January 1, 2010. AB 32 requires that by January 1, 2009, CARB adopt a scoping plan indicating how emission reductions will be achieved via regulations, market mechanisms and other actions.

Senate Bill 97





Senate Bill (SB) 97, signed in August 2007, acknowledges that climate change is an important environmental issue that requires analysis under CEQA. This bill directs the OPR to prepare, develop, and transmit to the Resources Agency guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions, by July 1, 2009. The Resources Agency is required to certify or adopt those guidelines by January 1, 2010. This bill also protects projects funded by the Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act of 2006, or the Disaster Preparedness and Flood Protection Bond Act of 2006 (Proposition 1B or 1E) from claims of inadequate analysis of GHG as a legitimate cause of action. This latter provision will be repealed on January 1, 2010. Thus, this "protection" is highly limited to a handful of projects and for a short time period.

The Role of Air Districts in the CEQA Process

Air districts assume one of three roles in the CEQA process. They may be lead agencies when they are adopting regulations and air quality plans. In some instances, they can also be a lead agency when approving permits to construct or operate for applicants subject to district rules. However, in many cases where an air district permit is involved, another agency has broader permitting authority over the project and assumes the role of lead agency. In these situations, the air district becomes what is referred to as a responsible agency under CEQA. When CEQA documents are prepared for projects that do not involve discretionary approval of a district regulation, plan or permit, the air district may assume the role of a concerned or commenting agency. In this role, it is typical for air districts to comment on CEQA documents where there may be air quality-related adverse impacts, such as projects that may create significant contributions to existing violations of ambient standards, cause a violation of an ambient standard or create an exposure to toxic air contaminants or odors. In some cases, the air district may also act in an "advisory" capacity to a lead agency early on in its review of an application for a proposed development project.

A few air districts in California began developing significance thresholds for use in CEQA analyses in the late 1980's and early 1990's. By the mid-1990's most air districts had developed CEQA thresholds for air quality analyses. Many of the districts have included in their guidance the analysis of rule development and permits that may be subject to CEQA.

What is Not Addressed in this Paper

Impacts of Climate Change to a Project

The focus of this paper is addressing adverse impacts to climate change and the ability to meet statewide GHG reduction goals caused by proposed new land development projects. CEQA also requires an assessment of significant adverse impacts a project might cause by bringing development and people into an area affected by climate change (CEQA Guidelines §15126.2). For example, an area that experiences higher average temperatures due to climate change may expose new development to more frequent exceedances and higher levels of ozone concentrations. Alternatively, a rise in sea level brought on by climate change may inundate new development locating in a low-lying area. The methodologies, mitigation and threshold approaches discussed in this paper do not specifically address the potential adverse impacts resulting from climate change that may affect a project.



Impacts from Construction Activity

Although construction activity has been addressed in the analytical methodologies and mitigation chapters, this paper does not discuss whether any of the threshold approaches adequately addresses impacts from construction activity. More study is needed to make this assessment or to develop separate thresholds for construction activity. The focus of this paper is the long-term adverse operational impacts of land use development.



Introduction

Any analysis of environmental impacts under CEQA includes an assessment of the nature and extent of each impact expected to result from the project to determine whether the impact will be treated as significant or less than significant. CEQA gives lead agencies discretion whether to classify a particular environmental impact as significant. "The determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved," ref: CEQA Guidelines §15064(b) ("Guidelines"). Ultimately, formulation of a standard of significance requires the lead agency to make a policy judgment about where the line should be drawn distinguishing adverse impacts it considers significant from those that are not deemed significant. This judgment must, however, be based on scientific information and other factual data to the extent possible (Guidelines §15064(b)).

CEQA does not require that agencies establish thresholds of significance. Guidelines §15064.7(a) encourages each public agency "…to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects. A threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which normally means the effect will be determined to be less than significant."

Once such thresholds are established, an impact that complies with the applicable threshold will "normally" be found insignificant and an impact that does not comply with the applicable threshold will "normally" be found significant.

Additionally, Guidelines §15064.7(b) requires that if thresholds of significance are adopted for general use as part of the lead agency's environmental review process they must be adopted by ordinance, resolution, rule or regulation, and developed through a public review process and be supported by substantial evidence.

While many public agencies adopt regulatory standards as thresholds, the standards do not substitute for a public agency's use of careful judgment in determining significance. They also do not replace the legal standard for significance (i.e., if there is a fair argument, based on substantial evidence in light of the whole record that the project may have a significant effect, the effect should be considered significant) (Guidelines §15064(f)(1). Also see *Communities for a Better Environment v. California Resource Agency* 103 Cal. App. 4th 98 (2002)). In other words, the adoption of a regulatory standard does not create an irrebuttable presumption that impacts below the regulatory standard are less than significant.

Summary of CEQA Thresholds at Air Districts



This section briefly summarizes the evolution of air district CEQA significance thresholds. Ventura County APCD, in 1980, was the first air district in California that formally adopted CEQA significance thresholds. Their first CEQA assessment document contained impact thresholds based on project type: residential, nonresidential, and government. Then, as now, the District's primary CEQA thresholds applied only to ROG and NO_x. The 1980 Guidelines did not address other air pollutants.

Santa Barbara County APCD and the Bay Area AQMD adopted thresholds in 1985. The South Coast AQMD recommended regional air quality thresholds in 1987 for CO, SO_2, NO_2, particulates, ROG, and lead. Most of the other California air districts adopted CEQA guidance and thresholds during the 1990's. Air districts have updated their thresholds and guidelines several times since they were first published.

Originally, most districts that established CEQA thresholds focused on criteria pollutants for which the district was nonattainment and the thresholds only addressed project level impacts. Updates during the 1990's began to add additional air quality impacts such as odors, toxic air contaminants and construction. Several air districts also developed thresholds for General Plans that relied on an assessment of the plan consistency with the district's air quality plans. A consistency analysis involves comparing the project's land use to that of the general plan and the population and employment increase to the forecasts underlying the assumptions used to develop the air quality plan.

Most air district thresholds for CEQA are based on the threshold for review under the New Source Review (NSR). The NSR threshold level is set by district rule and is different depending on the nonattainment classification of the air district. Areas with a less severe classification have a higher NSR trigger level while the most polluted areas have the lowest NSR trigger level. Some districts, such as Ventura County APCD, have significantly lower CEQA thresholds that are not tied to the NSR requirements. In Ventura, one set of CEQA thresholds is 25 pounds per day for all regions of Ventura County, except the Ojai Valley. The second set of CEQA thresholds was set at 5 pounds per day for the Ojai Valley.

The Sacramento Metropolitan AQMD bases its thresholds for ozone precursors on the projected land use share of emission reductions needed for attainment. The emission reductions needed to reach attainment are based on commitments made in the state implementation plan (SIP) prepared for the federal clean air act.

CEQA Considerations in Setting Thresholds

Public agencies use significance thresholds to disclose to their constituents how they plan on evaluating and characterizing the severity of various environmental impacts that could be associated with discretionary projects that they review. Significance thresholds are also used to help identify the level of mitigation needed to reduce a potentially significant impact to a less than significant level and to determine what type of an environmental document should be prepared for a project; primarily a negative declaration, mitigated negative declaration or an environmental impact report.



While public agencies are not required to develop significance thresholds, if they decide to develop them, they are required to adopt them by ordinance, resolution, rule or regulation through a public process. A lead agency is not restrained from adopting any significance threshold it sees as appropriate, as long as it is based on substantial evidence. CEQA Guidelines §15064.7 encourages public agencies to develop and publish significance thresholds that are identifiable, quantitative, qualitative or performance level that the agency uses in the determination of the significance of environmental effects. The courts have ruled that a "threshold of significance" for a given environmental effect is simply that level at which the lead agency finds the effects of the project to be significant.

Before an agency determines its course with regard to climate change and CEQA, it must be made clear that a threshold, or the absence of one, will not relieve a lead agency from having to prepare an EIR or legal challenges to the adequacy of an analysis leading to a conclusion, or lack of a conclusion, of significance under CEQA. CEQA has generally favored the preparation of an EIR where there is any substantial evidence to support a fair argument that a significant adverse environmental impact may occur due to a proposed project. This paper explores three alternative approaches to thresholds, including a no threshold option, a zero threshold option and a non-zero threshold option.

Fair Argument Considerations

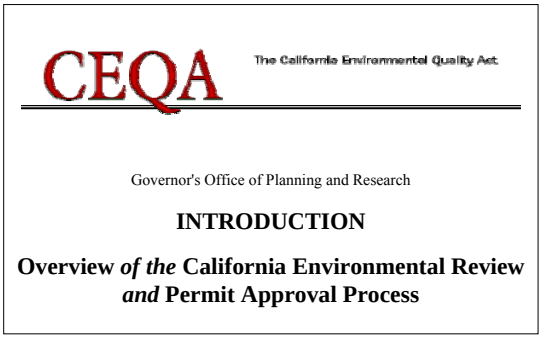
Under the CEQA fair argument standard, an EIR must be prepared whenever it can be fairly argued, based on substantial evidence in the administrative record, that a project may have a significant adverse effect on the environment. "Substantial evidence" comprises "enough relevant information and reasonable inferences from this information that a fair argument can be made to support a conclusion, even though other conclusions might also be reached." (Guidelines §15384) This means that if factual information is presented to the public agency that there is a reasonable possibility the project could have

a significant effect on the environment, an EIR is required even if the public agency has information to the contrary (Guidelines §15064 (f)).

The courts have held that the fair argument standard "establishes a low threshold for initial preparation of an EIR, which reflects a preference for resolving doubts in favor of environmental review." (*Santa Teresa Citizen Action Group v. City of San Jose* [2003] 114 Cal.App.4th 689) Although the determination of whether a fair argument exists is made by the public agency, that determination is subject to judicial scrutiny when challenged in litigation. When the question is whether an EIR should have been prepared, the court will review the administrative record for factual evidence supporting a fair argument.

The fair argument standard essentially empowers project opponents to force preparation of an EIR by introducing factual evidence into the record that asserts that the project may have a significant effect on the environment. This evidence does not need to be conclusive regarding the potential significant effect.

In 1998, the Resources Agency amended the State CEQA Guidelines to encourage the use of thresholds of significance. Guidelines §15064 (h) provided that when a project's impacts did not exceed adopted standards, the impacts were to be considered less than significant. The section went on to describe the types of adopted standards that were to be considered thresholds. Guidelines § 15064.7 provided that agencies may adopt thresholds of significance to guide their determinations of significance. Both of these sections were challenged when environmental groups sued the Resources Agency in 2000 over the amendments. The trial court concluded that §15064.7 was proper, if it was applied in the context of the fair argument standard.


CEQA The California Environmental Quality Act

Governor's Office of Planning and Research

INTRODUCTION

Overview *of the* California Environmental Review *and* Permit Approval Process

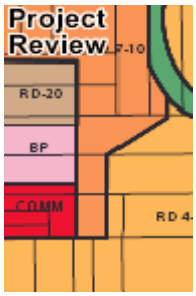
At the appellate court level, §15064(h) was invalidated. [2] Establishing a presumption that meeting an adopted standard would avoid significant impacts was "inconsistent with controlling CEQA law governing the fair argument approach." The Court of Appeal explained that requiring agencies to comply with a regulatory standard "relieves the agency of a duty it would have under the fair argument approach to look at evidence beyond the regulatory standard, or in contravention of the standard, in deciding whether an EIR must be prepared. Under the fair argument approach, any substantial evidence supporting a fair argument that a project may have a significant environmental effect would trigger the preparation of an EIR." (*Communities for a Better Environment v. California Resources Agency* [2002] 103 Cal.App.4th 98)

[2] Prior §15064(h) has been removed from the State CEQA Guidelines. Current §15064(h) discusses cumulative impacts.

In summary, CEQA law does not require a lead agency to establish significance thresholds for GHG. CEQA guidelines encourage the development of thresholds, but the absence of an adopted threshold does not relieve the agency from the obligation to determine significance.

Defensibility of CEQA Analyses

The basic purposes of CEQA, as set out in the State CEQA Guidelines, include: (1) informing decision makers and the public about the significant environmental effects of proposed projects; (2) identifying ways to reduce or avoid those impacts; (3) requiring the implementation of feasible mitigation measures or alternatives that would reduce or avoid those impacts; and (4) requiring public agencies to disclose their reasons for approving any project that would have significant and unavoidable impacts (Guidelines §15002). CEQA is enforced through civil litigation over procedure (i.e., did the public agency follow the correct CEQA procedures?) and adequacy (i.e., has the potential for impacts been disclosed, analyzed, and mitigated to the extent feasible?).



The California Supreme Court has held that CEQA is "to be interpreted in such manner as to afford the fullest possible protection to the environment within the reasonable scope of the statutory language." (*Friends of Mammoth v. Board of Supervisors* [1972] 8 Cal.3d 247, 259) Within that context, the role of the courts is to weigh the facts in each case and apply their judgment. Although the court may rule on the adequacy of the CEQA work, the court is not empowered to act in the place of the public agency to approve or deny the project for which the CEQA document was prepared. Further, the court's review is limited to the evidence contained in the administrative record that was before the public agency when it acted on the project.

Putting aside the issue of CEQA procedure, the defensibility of a CEQA analysis rests on the following concerns:

- whether the public agency has sufficiently analyzed the environmental consequences to enable decision makers to make an intelligent decision;
- whether the conclusions of the public agency are supported by substantial evidence in the administrative record; and
- whether the agency has made a good faith effort at the full disclosure of significant effects.

CEQA analyses need not be perfect or exhaustive -- the depth and breadth of the analysis is limited to what is "reasonably feasible." (Guidelines §15151) At the same time, the analysis "must include detail sufficient to enable those who did not participate in its preparation to understand and to consider meaningfully the issues raised by the proposed

project." (Laurel Heights Improvement Assn. v. Regents of University of California (1988) 47 Cal.3d 376)

By itself, establishment of a GHG threshold will not insulate individual CEQA analyses from challenge. Defensibility depends upon the adequacy of the analysis prepared by the lead agency and the process followed. However, the threshold can help to define the boundaries of what is a reasonable analysis by establishing when an analysis will be required and the basic scope of that analysis. The threshold would attempt to define the point at which an analysis will be required and when a level of impact becomes significant, requiring preparation of an EIR. If the threshold includes recommendations for the method or methods of analysis, it can establish the minimum level of analysis to address this issue.

Considerations in Setting Thresholds for Stationary Source Projects



In many respects, the analysis of GHG emissions from stationary sources is much more straightforward than the analysis of land use patterns, forecasted energy consumption, and emissions from mobile sources. The reason is that, for the most part, the latter analyses depend largely on predictive models with myriad inputs and have a wider range of error. Emissions from stationary sources involve a greater reliance on mass and energy balance calculations and direct measurements of emissions from the same or similar sources. Energy demand is more directly tied to production, and even associated mobile source emissions will likely fall within narrower predictive windows.

Implementing CEQA Without a Threshold

A lead agency is not required to establish significance thresholds for GHG emissions from stationary sources. The lead agency may find that it needs more information or experience evaluating GHG from these types of projects to determine an appropriate significance threshold. As with other project types, the lead agency could conduct a project specific analysis to determine whether an environmental impact report is needed and to determine the level of mitigation that is appropriate. The agency might also rely on thresholds established for criteria pollutants as a screening method, and analyze GHG emissions (and require mitigation) from projects with emissions above the criteria pollutant thresholds. Over time, the agency could amass information and experience with specific project categories that would support establishing explicit thresholds. The lead agency may also choose to base local CEQA thresholds on state guidelines or on the category-specific reduction targets established by ARB in its scoping plan for implementing AB32. Resource constraints and other considerations associated with implementing CEQA without GHG thresholds for stationary sources would be similar to those outlined for other types of projects (see Chapter 5 – No Threshold Option).

Implementing CEQA with Threshold of Zero

A lead agency may find that any increase in GHG emissions is potentially significant under CEQA. The resources and other considerations for implementing a threshold of zero for stationary sources are the same as those outlined for other types of projects (see Chapter 6 – Zero Threshold Option).

Implementing CEQA with a Non-Zero Threshold

A lead agency may identify one or more non-zero thresholds for significance of emissions of GHG from stationary sources. The agency could elect to rely on existing thresholds for reviewing new or modified stationary sources of GHG, if the state or local air district has established any. The agency could also apply the threshold(s) established for non-stationary sources to GHG emissions from stationary sources. Significance thresholds could also be established by ordinance, rule, or policy for a given category of stationary sources; this approach is especially conducive to a tiered threshold approach. For example, the agency could establish significance and mitigation tiers for stationary compression-ignition diesel-fueled generators. Under such an approach, the project proponent could be first required to use a lower GHG-emitting power source if feasible, and if not, to apply mitigation based on the size of the generator and other defined considerations, such as hours of operation. Certain classes of generators could be found to be insignificant under CEQA (e.g., those used for emergency stand-by power only, with a limit on the annual hours of use). As with non-stationary projects, the goal of establishing non-zero thresholds is to maximize environmental protection, while minimizing resources used. Resource and other considerations outlined for non-stationary projects are applicable here (see Chapter 7 – Non-Zero Threshold Options).

Implementing CEQA with Different Thresholds for Stationary and Non-stationary Projects

Although a lead agency may apply the same thresholds to stationary and non-stationary projects, it is not required to do so. There are, in fact, some important distinctions between the two types of projects that could support applying different thresholds. The lead agency should consider the methods used to estimate emissions. Are the estimates a "best/worst reasonable scenario" or are they based on theoretical maximum operation? How accurate are the estimates (are they based on models, simulations, emission factors, source test data, manufacturer specifications, etc.)? To what extent could emissions be reduced through regulations after the project is constructed if they were found to be greater than originally expected (i.e., is it possible to retrofit emissions control technology onto the source(s) of GHG at a later date, how long is the expected project life, etc.)? Are there emission limits or emissions control regulations (such as New Source Review) that provide certainty that emissions will be mitigated? Generally, stationary source emissions are based on maximum emissions (theoretical or allowed under law or regulation), are more accurate, and are more amenable to retrofit at a later time than non-stationary source emissions. It is also more likely that category specific

rules or some form of NSR will apply to stationary sources than non-stationary projects. Notwithstanding, it is almost always more effective and cost-efficient to apply emission reduction technology at the design phase of a project. There are, therefore, a number of considerations that need to be evaluated and weighed before establishing thresholds – and which may support different thresholds for stationary and non-stationary projects. Furthermore, the considerations may change over time as new regulations are established and as emissions estimation techniques and control technology evolves.

Direct GHG Emissions from Stationary Sources



The main focus of this paper has been the consideration of projects that do not, in the main, involve stationary sources of air pollution, because stationary source projects are generally a smaller percentage of the projects seen by most local land use agencies. That said, some discussion of stationary sources is warranted. As the broader program for regulating GHG from these sources is developed, the strategies for addressing them under CEQA will likely become more refined.

The primary focus of analysis of stationary source emissions has traditionally been those pollutants that are directly emitted by the source, whether through a stack or as fugitive releases (such as leaks). CAPCOA conducted a simplified analysis of permitting activity to estimate the number of stationary source projects with potentially significant emissions of greenhouse gases that might be seen over the course of a year. This analysis looked only at stationary combustion sources (such as boilers and generators), and only considered direct emissions. A lead agency under CEQA may see a different profile of projects than the data provided here suggest, depending on what other resources are affected by projects. In addition, air districts review like-kind replacements of equipment to ensure the new equipment meets current standards, but such actions might not constitute a project for many land use agencies or other media regulators. The data does provide a useful benchmark, however, for lead agencies to assess the order of magnitude of potential stationary source projects. A similar analysis is included for non-stationary projects in Chapter 7.

Table 1: Analysis of GHG Emissions from Stationary Combustion Equipment Permits[3]

	BAAQMD	SMAQMD	SJVUAPCD	SCAQMD
Total Applications for Year	1499	778	1535	1179
Affected at threshold of:				
900 metric tons/year	26	43	63	108
10,000 metric tons/year	7	5	26	8
25,000 metric tons/year	3	1	11	4

[3] District data varies based on specific local regulations and methodologies.

Emissions from Energy Use

In addition to the direct emissions of GHG from stationary projects, CEQA will likely need to consider the project's projected energy use. This could include an analysis of opportunities for energy efficiency, onsite clean power generation (e.g., heat/energy recovery, co-generation, geothermal, solar, or wind), and the use of dedicated power contracts as compared to the portfolio of generally available power. In some industries, water use and conservation may provide substantial GHG emissions reductions, so the CEQA analysis should consider alternatives that reduce water consumption and wastewater discharge. The stationary project may also have the opportunity to use raw or feedstock materials that have a smaller GHG footprint; material substitution should be evaluated where information is available to do so.



Emissions from Associated Mobile Sources

The stationary project will also include emissions from associated mobile sources. These will include three basic components: emissions from employee trips, emissions from delivery of raw or feedstock materials, and emissions from product transport. Employee trips can be evaluated using trip estimation as is done for non-stationary projects, and mitigations would include such measures as providing access to and incentives for use of public transportation, accessibility for bicycle and pedestrian modes of transport, employer supported car or vanpools (including policies such as guaranteed rides home, etc). Upstream and downstream emissions related to goods movement can also be estimated with available models. The evaluation will need to determine the extent of the transport chain that should be included (to ensure that all emissions in the chain have been evaluated and mitigated, but to avoid double counting). Mitigations could include direct actions by operators who own their own fleet, or could be implemented through contractual arrangements with independent carriers; again, the evaluation will need to consider how far up and down the chain mitigation is feasible and can be reasonably required.



Comparing Emissions Changes Across Pollutant Categories

The potential exists for certain GHG reduction measures to increase emissions of criteria and toxic pollutants known to cause or aggravate respiratory, cardiovascular, and other health problems. For instance, GHG reduction efforts such as alternative fuels and methane digesters may create significant levels of increased pollutants that are detrimental to the health of the nearby population (e.g.; particulate matter, ozone precursors, toxic air contaminants). Such considerations should be included in any CEQA analysis of a project's environmental impacts. While there are many win-win

strategies that can reduce both GHG and criteria/toxic pollutant emissions, when faced with situations that involve tradeoffs between the two, the more immediate public health concerns that may arise from an increase in criteria or toxic pollutant emissions should take precedence. GHG emission reductions could be achieved offsite through other mitigation programs.

Introduction

Under state law, it is the purview of each lead agency to determine what, if any, significance thresholds will be established to guide its review of projects under CEQA. While the state does provide guidelines for implementing CEQA, the guidelines have left the decision of whether to establish thresholds (and if so, at what level) to individual lead agencies. Frequently, lead agencies consult with resource-specific agencies (such as air districts) for assistance in determining what constitutes a significant impact on that specific resource.

With the passage of AB 32, the ARB has broad authority to regulate GHG emissions as necessary to meet the emission reduction goals of the statute. This may include authority to establish emission reduction requirements for new land use projects, and may also enable them to recommend statewide thresholds for GHG under CEQA.

In developing this white paper, CAPCOA recognizes that, as the GHG reduction program evolves over time, GHG thresholds and other policies and procedures for CEQA may undergo significant revision, and that uniform statewide thresholds and procedures may be established. This paper is intended to serve as a resource for public agencies until such time that statewide guidance is established, recognizing that decisions will need to be made about GHG emissions from projects before such guidance is available. This paper is not, however, uniform statewide guidance. As stated before, it outlines several possible approaches without endorsing any one over the others.

Some air districts may choose to use this paper to support their establishment of guidance for GHG under CEQA, including thresholds. This paper does not, nor should it be construed to require a district to implement any of the approaches evaluated here. Decisions about whether to provide formal local guidance on CEQA for projects with GHG emissions, including the question of thresholds, will be made by individual district boards.

Each of the 35 air districts operates independently and has its own set of regulations and programs to address the emissions from stationary, area and mobile sources, consistent with state and federal laws, regulations, and guidelines. The independence of the districts allows specific air quality problems to be addressed on a local level. In addition, districts have also established local CEQA thresholds of significance for criteria pollutants – also to address the specific air quality problems relative to that particular district.

The overall goal of air district thresholds is to achieve and maintain health based air quality standards within their respective air basins and to reduce transport of emissions to other air basins. In establishing recommended thresholds, air districts consider the existing emission inventory of criteria pollutants and the amount of emission reductions needed to attain and maintain ambient air quality standards.

However, unlike criteria pollutants where individual districts are characterized by varying levels of pollutant concentrations and source types, greenhouse gases (GHG) and their attendant climate change ramifications are a global problem and, therefore, may suggest a uniform approach to solutions that ensure both progress and equity.

Under SB97, the Office of Planning and Research is directed to prepare, develop, and transmit to the Resources Agency guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions through CEQA by July 1, 2009. Those guidelines may recommend thresholds. As stated, this paper is intended to provide a common platform of information and tools to support local decision makers until such time that statewide guidance or requirements are promulgated.

Local Ability to Promulgate District-Specific GHG Thresholds

One of the primary reasons behind the creation of air districts in California is the recognition that some regions within the state face more critical air pollution problems than others and, as has often been pointed out – one size does not fit all. For example, a "Serious" federal nonattainment district would need greater emission reductions than a district already in attainment – and, therefore, the more "serious" district would set its criteria pollutant CEQA thresholds of significance much lower than the air district already in attainment.

The action of GHGs is global in nature, rather than local or regional (or even statewide or national). Ultimately there may be a program that is global, or at least national in scope. That said, actions taken by a state, region, or local government can contribute to the solution of the global problem. Local governments are not barred from developing and implementing programs to address GHGs. In the context of California and CEQA, lead agencies have the primary responsibility and authority to determine the significance of a project's impacts.

Further, air districts have primary authority under state law for "control of air pollution from all sources, other than emissions from motor vehicles." (H&SC §40000) The term air contaminant or "air pollutant" is defined extremely broadly, to mean "any discharge, release, or other propagation into the atmosphere" and includes, but is not limited to, soot, carbon, fumes, gases, particulate matter, etc. Greenhouse gases and other global warming pollutants such as black carbon would certainly be included in this definition, just as the U.S. Supreme Court held in Massachusetts v. EPA that greenhouse gases were air pollutants under the federal Clean Air Act. Therefore, air districts have the primary authority to regulate global warming pollutants from nonvehicular sources. AB 32 does not change this result. Although it gives wide responsibility to CARB to regulate greenhouse gases from all sources, including nonvehicular sources, it does not preempt the districts. AB 32 specifically states That "nothing in this division shall limit or expand the existing authority of any district..."(H&SC § 38594). Thus, districts and CARB retain concurrent authority over nonvehicular source greenhouse gas emissions.

Introduction

The CEQA statutes do not require an air district or any lead agency to establish significance thresholds under CEQA for any pollutant. While there are considerations that support the establishment of thresholds (which are discussed in other sections of this document), there is no obligation to do so.

An air district or other lead agency may elect not to establish significance thresholds for a number of reasons. The agency may believe that the global nature of the climate change problem necessitates a statewide or national framework for consideration of environmental impacts. SB 97 directs OPR to develop "guidelines for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions by July 1, 2009," and directs the California Resources Agency to certify and adopt the guidelines by June 30, 2010.



An agency may also believe there is insufficient information to support selecting one specific threshold over another. As described earlier, air districts have historically set CEQA thresholds for air pollutants in the context of the local clean air plan, or (in the case of toxic air pollutants) within the framework of a rule or policy that manages risks and exposures due to toxic pollutants. There is no current framework that would similarly manage impacts of greenhouse gas pollutants, although the CARB is directed to establish one by June 30, 2009, pursuant to AB 32. A local agency may decide to defer any consideration of thresholds until this framework is in place.

Finally, an agency may believe that the significance of a given project should be assessed on a case-by-case basis in the context of the project at the time it comes forward.

Implementing CEQA Without Significance Thresholds for GHG

The absence of a threshold does not in any way relieve agencies of their obligations to address GHG emissions from projects under CEQA. The implications of not having a threshold are different depending on the role the agency has under CEQA – whether it is acting in an advisory capacity, as a responsible agency, or as a lead agency.

Implications of No Thresholds for an Agency Acting in an Advisory Capacity

Air districts typically act in an advisory capacity to local governments in establishing the framework for environmental review of air pollution impacts under CEQA. This may include recommendations regarding significance thresholds, analytical tools to assess emissions and impacts, and mitigations for potentially significant impacts. Although districts will also address some of these issues on a project-specific basis as responsible agencies, they may provide general guidance to local governments on these issues that

are program wide, and these are advisory (unless they have been established by regulation).

An air district that has not established significance thresholds for GHG will not provide guidance to local governments on this issue. This does not prevent the local government from establishing thresholds under its own authority. One possible result of this would be the establishment of different thresholds by cities and counties within the air district. Alternatively, the air district could advise local governments not to set thresholds and those jurisdictions may follow the air district's guidance.

It is important to note here (as has been clearly stated by the Attorney General in comments and filings) that lack of a threshold does *not* mean lack of significance. An agency may argue lack of significance for any project, but that argument would have to be carried forth on a case-by-case, project specific basis. By extension then, a decision not to establish thresholds for GHG is likely to result in a greater workload for responsible and lead agencies as they consider individual projects under CEQA.

Implications of No Thresholds for a Responsible Agency

If there are no established thresholds of significance, the significance of each project will have to be determined during the course of review. The responsible agency (e.g., the air district) will review each project referred by the lead agency. The review may be qualitative or quantitative in nature. A qualitative review would discuss the nature of GHG emissions expected and their potential effect on climate change as the district understands it. It could also include a discussion of the relative merits of alternative scenarios. A quantitative analysis would evaluate, to the extent possible, the expected GHG emissions; it would also need to evaluate their potential effect on climate change and might include corresponding analysis of alternatives. The air district, as a responsible agency, may also identify mitigation measures for the project.

The lack of established thresholds will make the determination of significance more resource intensive for each project. The district may defer to the lead agency to make this determination, however the district may be obligated, as a responsible agency, to evaluate the analysis and determination.



Implications of No Thresholds for a Lead Agency

The main impact of not having significance thresholds will be on the primary evaluation of projects by the lead agency. Without significance thresholds, the agency will have to conduct some level of analysis of every project to determine whether an environmental impact report is needed. There are three fundamental approaches to the case-by-case analysis of significance, including presumptions of significance or insignificance, or no presumption:

1. The agency can begin with a presumption of significance and the analysis would be used to support a case-specific finding of no significance. This is similar to establishing a threshold of zero, except that here, the "threshold" is rebuttable. This approach may result in a large number of projects proceeding to preparation of an environmental impact report. Because of the attendant costs, project proponents may challenge the determination of significance, although formal challenge is less likely than attempts to influence the determination.

2. The agency can begin with a presumption of insignificance, and the analysis would be used to support a case-specific finding of significance. A presumption of insignificance could be based on the perspective that it would be speculative to attempt to identify the significance of GHG emissions from a project relative to climate change on a global scale. This approach might reduce the number of projects proceeding to preparation of environmental impact reports. It is likely to have greater success with smaller projects than larger ones, and a presumption of *insignificance* may be more likely to be challenged by project opponents.



3. It is not necessary for the lead agency to have any presumption either way. The agency could approach each project from a *tabula rasa* perspective, and have the determination of significance more broadly tied to the specific context of the project; this approach is likely to be resource intensive, and creates the greatest uncertainty for project proponents. To the extent that it results in a lead agency approving similar projects based on different determinations of significance for GHG emissions, it may be more vulnerable to challenge from either proponents or opponents of the project. Alternatively, in the absence of either thresholds or presumptions, the lead agency could use each determination of significance to build its approach in the same way that subsequent judgments define the law.

Relevant Citations

The full text of relevant citations is in Appendix A.

Public Resources Code – §21082.2, Significant Effect on Environment; Determination; Environmental Impact Report Preparation.

State CEQA Guidelines – §15064, Determining the Significance of the Environmental Effects Caused by a Project.

Introduction

If an air district or lead agency determines that any degree of project-related increase in GHG emissions would contribute considerably to climate change and therefore would be a significant impact, it could adopt a zero-emission threshold to identify projects that would need to reduce their emissions. A lead agency may determine that a zero-emission threshold is justified even if other experts may disagree. A lead agency is not prevented from adopting any significance threshold it sees as appropriate, as long as it is based on substantial evidence.

If the zero threshold option is chosen, all projects subject to CEQA would be required to quantify and mitigate their GHG emissions, regardless of the size of the project or the availability of GHG reduction measures available to reduce the project's emissions. Projects that could not meet the zero-emission threshold would be required to prepare environmental impact reports to disclose the unmitigable significant impact, and develop the justification for a statement of overriding consideration to be adopted by the lead agency.



Implementing CEQA With a Zero Threshold for GHG

The scientific community overwhelmingly agrees that the earth's climate is becoming warmer, and that human activity is playing a role in climate change. Unlike other environmental impacts, climate change is a global phenomenon in that all GHG emissions generated throughout the earth contribute to it. Consequently, both large and small GHG generators cause the impact. While it may be true that many GHG sources are individually too small to make any noticeable difference to climate change, it is also true that the countless small sources around the globe combine to produce a very substantial portion of total GHG emissions.

A zero threshold approach is based on a belief that, 1) all GHG emissions contribute to global climate change and could be considered significant, and 2) not controlling emissions from smaller sources would be neglecting a major portion of the GHG inventory.

CEQA explicitly gives lead agencies the authority to choose thresholds of significance. CEQA defers to lead agency discretion when choosing thresholds. Consequently, a zero-emission threshold has merits.

The CEQA review process for evaluating a project's impact on global climate change under the zero threshold option would involve several components. Air quality sections would be written by lead agencies to include discussions on climate change in CEQA documents, GHG emissions would be calculated, and a determination of significance would be made. The local air districts would review and comment on the climate change discussions in environmental documents. Lead agencies may then revise final EIRs to accommodate air district comments. More than likely, mitigation measures will be specified for the project, and a mitigation monitoring program will need to be put in place to ensure that these measures are being implemented.

Since CEQA requires mitigation to a less than significant level, it is conceivable that many projects subjected to a zero threshold could only be deemed less than significant with offsite reductions or the opportunity to purchase greenhouse gas emission reduction credits. GHG emission reduction credits are becoming more readily available however the quality of the credits varies considerably. High quality credits are generated by actions or projects that have clearly demonstrated emission reductions that are real, permanent, verifiable, enforceable, and not otherwise required by law or regulation. When the pre- or post-project emissions are not well quantified or cannot be independently confirmed, they are considered to be of lesser quality. Similarly, if the reductions are temporary in nature, they are also considered to be poor quality. Adoption of a zero threshold should consider the near-term availability and the quality of potential offsets.

There are also environmental justice concerns about the effects of using offsite mitigations or emission reduction credits to offset, or mitigate, the impacts of a new project. Although GHGs are global pollutants, some of them are emitted with co-pollutants that have significant near-source or regional impacts. Any time that increases in emissions at a specific site will be mitigated at a remote location or using emission reduction credits, the agency evaluating the project should ensure that it does not create disproportionate impacts.





Administrative Considerations

If electing to pursue a zero threshold, an air district or lead agency should consider the administrative costs and the environmental review system capacity. Some projects that previously would have qualified for an exemption could require further substantial analysis, including preparation of a Negative Declaration (ND), a Mitigated Negative Declaration (MND) or an EIR. Moreover, the trade-offs between the volume of projects requiring review and the quality of consideration given to reviews should be considered. It may also be useful to consider whether meaningful mitigation can be achieved from smaller projects.

Consideration of Exemptions from CEQA

A practical concern about identifying GHG emissions as a broad cumulative impact is whether the zero threshold option will preclude a lead agency from approving a large set of otherwise qualified projects utilizing a Categorical Exemption, ND, or MND. The results could be a substantial increase in the number of EIR's. This is a valid and challenging concern, particularly for any threshold approach that is based on a zero threshold for net GHG emission increases.

CEQA has specified exceptions to the use of a categorical exception. Specifically, CEQA Guidelines §15300.2 includes the following exceptions:

"(b) Cumulative Impact. All exemptions for these classes are inapplicable when the cumulative impact of successive projects of the same type in the same place, over time is significant."

(c) Significant Effect. A categorical exemption shall not be used for an activity where there is a reasonable possibility that the activity will have a significant effect on the environment due to unusual circumstances."

These CEQA Guidelines sections could be argued to mean that any net increase in GHG emissions would preclude the use of a categorical exemption. However, as described below, if the following can be shown, then the exceptions above could be argued not to apply:

(1) Cumulative local, regional and/or state GHG emissions are being reduced or will be reduced by adopted, funded, and feasible measures in order to meet broader state targets.

(2) Mandatory state or local GHG reduction measures would apply to the project's emissions such that broader GHG reduction goals would still be met and the project contributions would not be cumulatively considerable.

(3) Project GHG emissions are below an adopted significance threshold designed to take into account the cumulative nature of GHG emissions.

A similar argument could be made relative to the use of a ND (provided no additional mitigation (beyond existing mandates) is required to control GHG emissions) and to the use of a MND instead of an EIR. However, due to the "fair argument" standard, which is discussed in Chapter 3, caution is recommended in use of a ND or MND unless all three elements above can be fully supported through substantial evidence and there is no substantial evidence to the contrary. Establishing a significance threshold of zero is likely to preclude the use of a categorical exemption.

Relevant Citations

The full text of relevant citations is in Appendix A.

Public Resources Code – §21004, Mitigating or Avoiding a Significant Effect; Powers of Public Agency.

State CEQA Guidelines – §15064, Determining the Significance of the Environmental Effects Caused by a Project.

State CEQA Guidelines – §15130, Discussion of Cumulative Impacts.

State CEQA Guidelines – §15064.7, Thresholds of Significance.

Introduction

A non-zero threshold could minimize the resources spent reviewing environmental analyses that do not result in real GHG reductions or to prevent the environmental review system from being overwhelmed. The practical advantages of considering non-zero thresholds for GHG significance determinations can fit into the concept regarding whether the project's GHG emissions represent a "considerable contribution to the cumulative impact" and therefore warrant analysis.

Specifying a non-zero threshold could be construed as setting a *de minimis* value for a cumulative impact. In effect, this would be indicating that there are certain GHG emission sources that are so small that they would not contribute substantially to the global GHG budget. This could be interpreted as allowing public agencies to approve certain projects without requiring any mitigation of their GHG. Any threshold framework should include a proper context to address the *de minimis* issue. However, the CEQA Guidelines recognize that there may be a point where a project's contribution, although above zero, would not be a *considerable contribution* to the cumulative impact and, therefore, not trigger the need for a significance determination.

GHG emissions from all sources are under the purview of CARB and as such may eventually be "regulated" no matter how small. Virtually all projects will result in some direct or indirect release of GHG. However, a decision by CARB to regulate a class of sources does not necessarily mean that an individual source in that class would constitute a project with significant GHG impacts under CEQA. For example, CARB has established criteria pollutant emission standards for automobiles, but the purchase and use of a single new car is not considered a project with significant impacts under CEQA. At the same time, it is important to note that it is likely that all meaningful sources of emissions, no matter how small are likely to be considered for regulation under AB 32. It is expected that projects will have to achieve some level of GHG reduction to comply with CARB's regulations meant to implement AB 32. As such all projects will have to play a part in reducing our GHG emissions budget and no project, however small, is truly being considered *de minimis* under CARB's regulations.

This chapter evaluates a range of conceptual approaches toward developing GHG significance criteria. The air districts retained the services of J&S an environmental consulting, firm to assist with the development of a Statute and Executive Order-based threshold (Approach 1) and a tiered threshold (Approach 2) based on a prescribed list of tasks and deliverables. Time and financial constraints limited the scope and depth of this analysis, however, the work presented here may be useful in developing interim guidance while AB 32 is being implemented. J&S recognized that approaches other than those described here could be used.

As directed, J&S explored some overarching issues, such as:

- what constitutes "new" emissions?

- how should "baseline emissions" be established?
- what is cumulatively "considerable" under CEQA?
- what is "business as usual" ? and
- should an analysis include "life-cycle" emissions?

The answers to these issues were key to evaluating each of the threshold concepts.

Approach 1 – Statute and Executive Order Approach

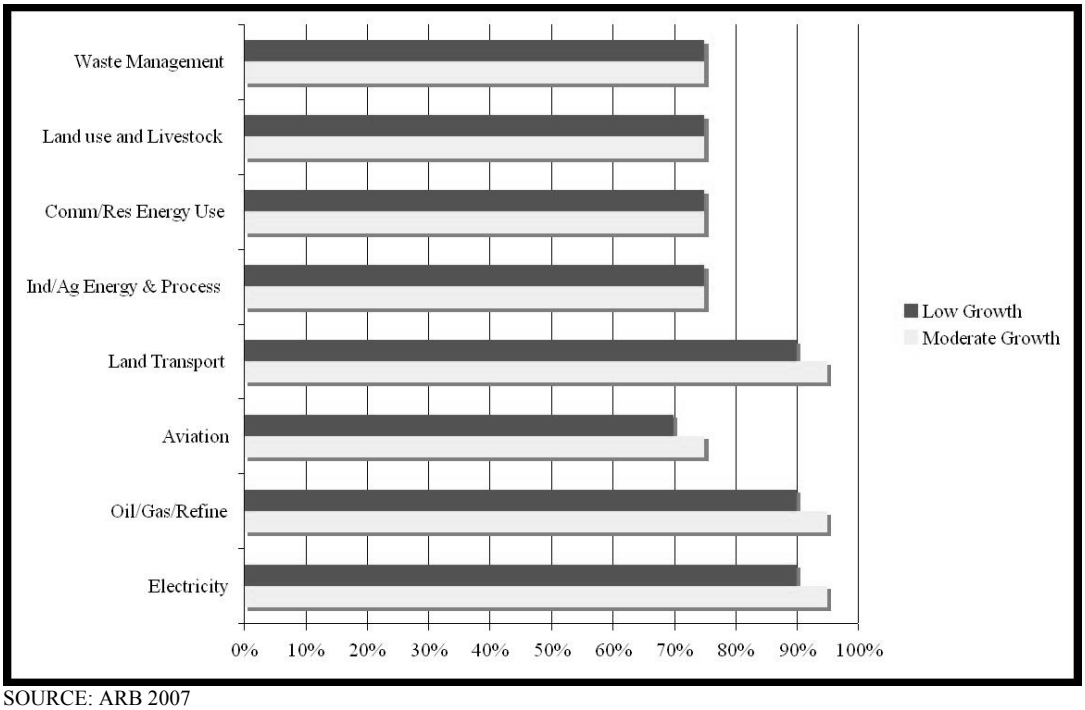
Thresholds could be grounded in existing mandates and their associated GHG emission reduction targets. A project would be required to meet the targets, or reduce GHG emissions to the targets, to be considered less than significant.

AB 32 and S-3-05 target the reduction of statewide emissions. It should be made clear that AB 32 and S-3-05 do not specify that the emissions reductions should be achieved through uniform reduction by geographic location or by emission source characteristics. For example, it is conceivable, although unlikely, that AB 32 goals could be achieved by new regulations that only apply to urban areas or that only apply to the transportation and/or energy sector. However, this approach to evaluating GHG under CEQA is based on the presumption that a new project must at least be consistent with AB 32 GHG emission reduction mandates.

The goal of AB 32 and S-3-05 is the significant reduction of future GHG emissions in a state that is expected to rapidly grow in both population and economic output. As such, there will have to be a significant reduction in the per capita GHG output for these goals to be met. CEQA is generally used to slow or zero the impact of new emissions, leaving the reduction of existing emission sources to be addressed by other regulatory means. With these concepts in mind, four options were identified for statute/executive order-based GHG significance thresholds and are described below.

Threshold 1.1: AB 32/S-3-05 Derived Uniform Percentage-Based Reduction. AB 32 requires the state to reduce California-wide GHG emissions to 1990 levels by 2020. Reducing greenhouse gas emission levels from 2020 to 1990 levels could require a 28 to 33 percent reduction of business-as-usual GHG emissions depending on the methodology used to determine the future emission inventories. The exact percent reduction may change slightly once CARB finalizes its 1990 and 2020 inventory estimates. In this context, business-as-usual means the emissions that would have occurred in the absence of the mandated reductions. The details of the business-as-usual scenario are established by CARB in the assumptions it uses to project what the state's GHG emissions would have been in 2020, and the difference between that level and the level that existed in 1990 constitutes the reductions that must be achieved if the mandated goals are to be met.

This threshold approach would require a project to meet a percent reduction target based on the average reductions needed from the business-as-usual emission from all GHG sources. Using the 2020 target, this approach would require all discretionary projects to achieve a 33 percent reduction from projected business-as-usual emissions in order to be considered less than significant. A more restrictive approach would use the 2050 targets. S-3-05 seeks to reduce GHG emissions to 80 percent below 1990 levels by 2050. To reach the 2050 milestone would require an estimated 90 percent reduction (effective immediately) of business-as-usual emissions. Using this goal as the basis for a significance threshold may be more appropriate to address the long-term adverse impacts associated with global climate change. Note that AB 32 and S-3-05 set emission inventory goals at milestone years; it is unclear how California will progress to these goals in non-milestone years.



SOURCE: ARB 2007

Threshold 1.2: Uniform Percentage-Based (e.g.50%) Reduction for New Development. This threshold is based on a presumption that new development should contribute a greater percent reduction from business-as-usual because greater reductions can be achieved at lower cost from new projects than can be achieved from existing sources. This approach would establish that new development emit 50 percent less GHG emissions than business-as-usual development. This reduction rate is greater than the recommended reduction rate for meeting the Threshold 1.1 2020 target (33 percent) but is significantly less restrictive than the Threshold 1.1 2050 target reduction rate (90 percent). If a 50 percent GHG reduction were achieved from new development, existing emissions would have to be reduced by 25 to 30 percent in order to meet the 2020 emissions goal depending on the year used to determine the baseline inventory. Although this reduction goal is reasonable for achieving the 2020 goal, it would not be possible to

reach the 2050 emissions target with this approach even if existing emissions were 100 percent controlled.

Threshold 1.3: Uniform Percentage-Based Reduction by Economic Sector. This threshold would use a discrete GHG reduction goal specific to the economic sector associated with the project. There would be specific reduction goals for each economic sector, such as residential, commercial, and industrial development. Specifying different reduction thresholds for each market sector allows selection of the best regulatory goal for each sector taking into account available control technology and costs. This approach would avoid over-regulating projects (i.e. requiring emissions to be controlled in excess of existing technology) or under-regulating projects (i.e. discouraging the use of available technology to control emissions in excess of regulations). This approach requires extensive information on the emission inventories and best available control technology for each economic sector. This data will be compiled as CARB develops its scoping plan under AB 32 and its implementing regulations; as a result, this approach will be more viable in the long term.

Threshold 1.4: Uniform Percentage-Based Reduction by Region. AB 32 and S-3-05 are written such that they apply to a geographic region (i.e. the entire state of California) rather than on a project or sector level. One could specify regions of the state such as the South Coast Air Basin, Sacramento Valley, or Bay Area which are required to plan (plans could be developed by regional governments, such as councils of governments) and demonstrate compliance with AB 32 and S-3-05 reduction goals at a regional level. To demonstrate that a project has less than significant emissions, one would have to show compliance with the appropriate regional GHG plan. Effectively this approach allows for analysis of GHG emissions at a landscape scale smaller than the state as a whole. Specifying regions in rough correlation to existing air basins or jurisdictional control allows for regional control of emissions and integration with regional emission reduction strategies for criteria and toxic air pollutants. Although differing GHG reduction controls for each region are possible, it is likely that all regions would be

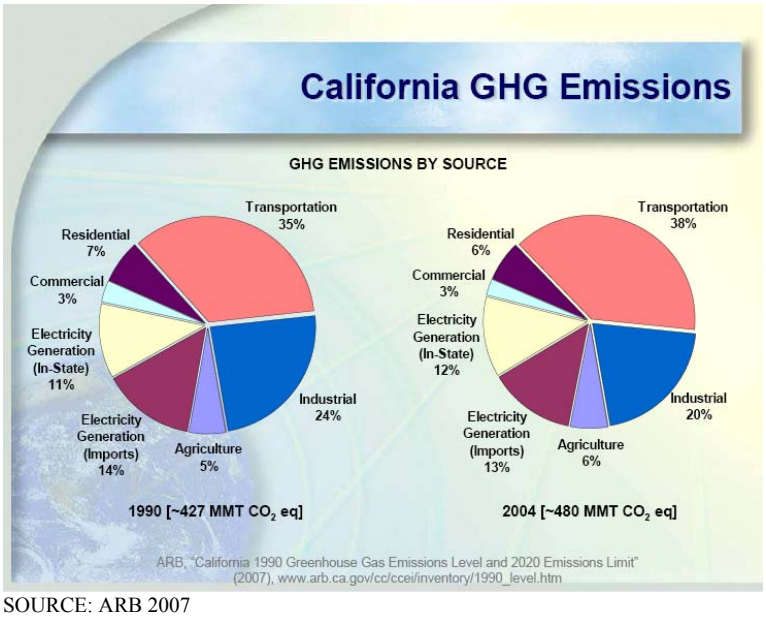


required to achieve 1990 emission inventories by the year 2020 and 80 percent less emissions by 2050. Threshold 1.4 is considered viable long-term significance criteria that is unlikely to be used in the short term.

Implementing CEQA Thresholds Based on Emission Reduction Targets

Characterizing Baseline and Project Emissions

While the population and economy of California is expanding, all new projects can be considered to contribute new emissions. Furthermore, GHG impacts are exclusively cumulative impacts; there are no non-cumulative GHG emission impacts from a climate change perspective. "Business-as-usual" is the projection of GHG emissions at a future date based on current technologies and regulatory requirements in absence of other reductions. For example to determine the future emissions from a power plant for "business-as-usual" one would multiply the projected energy throughput by the current emission factor for that throughput. If adopted regulations (such as those that may be promulgated by CARB for AB 32) dictate that power plant emissions must be reduced at some time in the future, it is appropriate to consider these regulation standards as the new business-as-usual for a future date. In effect, business-as-usual will continue to evolve as regulations manifest. Note that "business-as-usual" defines the CEQA No Project conditions, but does not necessarily form the baseline under CEQA. For instance, it is common to subtract the future traffic with and without a project to determine the future cumulative contribution of a project on traffic conditions. However, existing conditions at the time of issuance of the notice of preparation is normally the baseline.



SOURCE: ARB 2007

Establishing Emission Reduction Targets

One of the obvious drawbacks to using a uniform percent reduction approach to GHG control is that it is difficult to allow for changes in the 1990 and future emission inventories estimates. To determine what emission reductions are required for new projects one would have to know accurately the 1990 budget and efficacy of other GHG promulgated regulations as a function of time. Since CARB will not outline its

regulation strategy for several more years, it is difficult to determine accurately what the new project reductions should be in the short term. Future updates to the 1990 inventory could necessitate changes in thresholds that are based on that inventory. It is important to note that it is difficult to create near term guidance for a uniform reduction threshold strategy since it would require considerable speculation regarding the implementation and effectiveness of forthcoming CARB regulations.

Of greater importance are the assumptions used to make the projected 2020 emission inventories. Projecting future inventories over the next 15-50 years involves substantial uncertainty. Furthermore, there are likely to be federal climate change regulations and possibly additional international GHG emission treaties in the near future. To avoid such speculation, this paper defines all future emission inventories as hypothetical business-as-usual projections.

This white paper is intended to support local decisions about CEQA and GHG in the near term. During this period, it is unlikely that a threshold based on emission reduction targets would need to be changed. However, it is possible that future inventory updates will show that targets developed on the current inventory were not stringent enough, or were more stringent than was actually needed.

Approach 2 – Tiered Approach

The goal of a tiered threshold is to maximize reduction predictability while minimizing administrative burden and costs. This would be accomplished by prescribing feasible mitigation measures based on project size and type, and reserving the detailed review of an EIR for those projects of greater size and complexity. This approach may require inclusion in a General Plan, or adoption of specific rules or ordinances in order to fully and effectively implement it.

A tiered CEQA significance threshold could establish different levels at which to determine if a project would have a significant impact. The tiers could be established based on the gross GHG emission estimates for a project or could be based on the physical size and characteristics of the project. This approach would then prescribe a set of GHG mitigation strategies that would have to be incorporated into the project in order for the project to be considered less than significant.

The framework for a tiered threshold would include the following:

- disclosure of GHG emissions for all projects;
- support for city/county/regional GHG emissions reduction planning;
- creation and use of a “green list” to promote the construction of projects that have desirable GHG emission characteristics;
- a list of mitigation measures;

- a decision tree approach to tiering; and
- quantitative or qualitative thresholds.

Decision-Tree Approach to Tiering

CEQA guidance that allows multiple methodologies to demonstrate GHG significance will facilitate the determination of significance for a broad range of projects/plans that would otherwise be difficult to address with a single non-compound methodology. Even though there could be multiple ways that a project can determine GHG significance using a decision-tree approach, only one methodology need be included in any single CEQA document prepared by the applicant. The presence of multiple methodologies to determine significance is designed to promote flexibility rather than create additional analysis overhead. Figure 1 shows a conceptual approach to significance determination using a tiered approach that shows the multiple routes to significance determination.

Figure 1 Detail Description

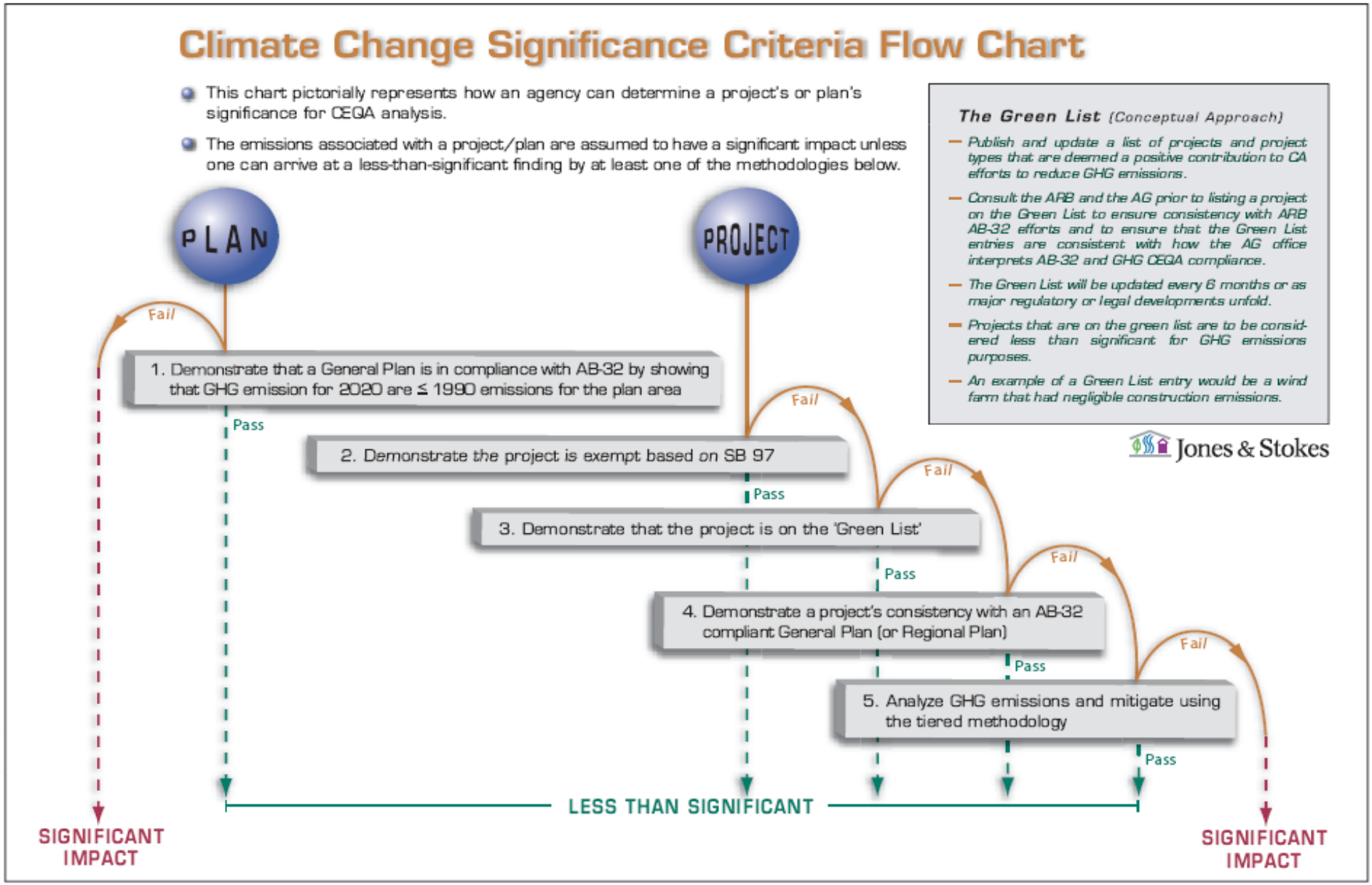
Figure 1 pictorially represents how an agency can determine a project's or plan's significance for CEQA analysis using the non-zero threshold methodology. The emissions associated with a project/plan are assumed to have a significant impact unless one can arrive at a less-than-significant finding by at least one of the methodologies below.

1. Demonstrate that a General Plan (GP) or Regional Plan is in Compliance with AB32

   - For most GPs or RPs this will require demonstration that projected 2020 emissions will be equal to or less than 1990 emissions.
   - GPs or RPs are expected to fully document 1990 and 2020 GHG emission inventories.
   - Projection of 2020 emissions is complicated by the fact that CARB is expected to promulgate emission reductions in the short term. Until explicit CARB regulations are in place, unmitigated GP 2020 emission inventories represent business-as-usual scenarios.
   - EIRs for GPs or RPs which demonstrate 2020 mitigated emissions are less than or equal to 1990 emissions are considered less than significant.

2. Demonstrate the Project is Exempt Based on SB 97

   - As specified in SB 97, projects that are funded under November 2006 Proposition 1B (Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act) and 1C (Disaster Preparedness and Flood Prevention Bond Act) may be exempt from analysis until January 1, 2010.



Jones & Stokes

Figure 1
Climate Change Significance Criteria Flow Chart

- An exemption can be used in an ND, MND, or EIR to support a less than significant finding for GHG impacts.

3. Demonstrate that the Project is on the 'Green List'

- This list would include projects that are deemed a positive contribution to California efforts to reduce GHG emissions. If the project is of the type described on the Green List it is considered less than significant.
- If the Green List entry description requires mitigation for impacts other than GHG, this methodology can be used in MNDs or EIRs; if the Green List entry does not require mitigation this methodology can be used in NDs, MNDs, or EIRs.

4. Demonstrate a Project's Compliance with a General Plan

- If a project is consistent with an appropriate General Plan's Greenhouse Gas Reduction Plan (GGRP), a project can be declared less than significant.
- Note that at this time there are no known jurisdictions that have a GGRP that has been fully subject to CEQA review. While Marin County has adopted a forward-thinking GGRP and it is described in the most recent GP update, the associated EIR does not analyze the secondary environmental impacts of some of the GGRP measures such as tidal energy. While one can reference GGRPs that have not been reviewed fully in CEQA, to attempt to show a project's compliance with such a plan as evidence that the project's GHG emission contributions are less than significant may not be supported by substantial evidence that cumulative emissions are being fully addressed in the particular jurisdiction.
- Compliance with a CEQA-vetted GGRP can be cited as evidence for all CEQA documents (Categorical Exemption, ND, MND, and EIR).

5. Analyze GHG Emissions and Mitigate using the Tiered Methodology

- Guidance and mitigation methodology for various development projects (residential, commercial, industrial) are listed in the form of tiered thresholds. If a project incorporates the mitigation measures specified in the tiered threshold tables the project is considered less than significant.
- All project emissions are considered less than significant if they are less than the threshold(s).
- If the tiered approach requires mitigation, this methodology can be used in MNDs or EIRs; if the tiered approach does not require mitigation this methodology can be used in NDs, MNDs, or EIRs.

The Green List

- The Green List would be a list of projects and project types that are deemed a positive contribution to California's efforts to reduce GHG emissions.
- If this approach is followed, it is suggested that CARB and the Attorney General (AG) are consulted prior to listing a project on the Green List to ensure consistency with CARB AB 32 efforts and to ensure that the Green List entries are consistent with how the AG office interprets AB 32 and GHG CEQA compliance.
- The Green List should be updated every 6 months or as major regulatory or legal developments unfold.
- Projects that are on the Green List are to be considered less than significant for GHG emissions purposes.
- A tentative list of potential Green List entries is presented below. Actual Green List entries should be far more specific and cover a broad range of project types and mitigation approaches. The list below is merely a proof-of-concept for the actual Green List.

  1. Wind farm for the generation of wind-powered electricity
  2. Extension of transit lines to currently developed but underserved communities
  3. Development of high-density infill projects with easily accessible mass transit
  4. Small hydroelectric power plants at existing facilities that generate 5 mw or less (as defined in Class 28 Categorical Exemption)
  5. Cogeneration plants with a capacity of 50 mw or less at existing facilities (as defined in Class 29 Cat Exemption)
  6. Increase in bus service or conversion to bus rapid transit service along an existing bus line
  7. Projects with LEED "Platinum" rating
  8. Expansion of recycling facilities within existing urban areas
  9. Recycled water projects that reduce energy consumption related to water supplies that services existing development
  10. Development of bicycle, pedestrian, or zero emission transportation infrastructure to serve existing regions

There are also several options for tiering and thresholds, as shown in Table 2 below. One could establish strictly numeric emissions thresholds and require mitigation to below the specific threshold to make a finding of less than significant. One could establish narrative emissions threshold that are based on a broader context of multiple approaches to GHG reductions and a presumption that projects of sufficiently low GHG intensity are less than significant.

In Concept 2A, a zero threshold would be applied to projects and thus only projects that result in a reduction of GHG emissions compared to baseline emissions would be less than significant absent mitigation. All projects would require quantified inventories. All projects that result in a net increase of GHG emissions would be required to mitigate their emissions to zero through direct mitigation or through fees or offsets or the impacts

Table 2: Approach 2 Tiering Options

	Concept 2A Zero	Concept 2B Quantitative	Concept 2C Qualitative
Tier 1	Project results in a net reduction of GHG emissions *Less than Significant*	Project in compliance with an AB 32-compliant General/Regional Plan, on the Green List, or below Tier 2 threshold. Level 1 Reductions (Could include such measures as: bike parking, transit stops for planned route, Energy Star roofs, Energy Star appliances, Title 24, water use efficiency, etc.) *Less than Significant*	Project in compliance with an AB 32-compliant General/Regional Plan, on the Green List, or below Tier 2 threshold. Level 1 Reductions (See measures under 2B) *Less than Significant*
Tier 2	Project results in net increase of GHG emissions Mitigation to zero (including offsets) *Mitigated to Less than Significant*	Above Tier 2 threshold Level 2 Mitigation (Could include such measures as: Parking reduction beyond code, solar roofs, LEED Silver or Gold Certification, exceed Title 24 by 20%, TDM measures, etc.) *Mitigated to Less than Significant*	Above Tier 2 threshold Level 2 Mitigation (See measures under 2B) *Mitigated to Less than Significant*
Tier 3	Mitigation infeasible to reduce emissions to zero (e.g., cost of offsets infeasible for project or offsets not available) *Significant and Unavoidable*	Above Tier 2 threshold With Level 1, 2 Mitigation Level 3 Mitigation: (Could include such measures as: On-site renewable energy systems, LEED Platinum certification, Exceed Title 24 by 40%, required recycled water use for irrigation, zero waste/high recycling requirements, mandatory transit passes, offsets/carbon impact fees) *Mitigated to Less than Significant*	Above Tier 3 thresholds Quantify Emissions, Level 3 Mitigation (see measures under 2B), and Offsets for 90% of remainder *Significance and Unavoidable*

would be identified as significant and unavoidable. This could be highly problematic and could eliminate the ability to use categorical exemptions and negative declarations for a wide range of projects.

In Concepts 2B and 2C, the first tier of a tiered threshold includes projects that are within a jurisdiction with an adopted greenhouse gas reduction plan (GGRP) and General Plan/Regional Plan that is consistent with AB 32 (and in line with S-3-05), or are on the Green List, or are below the Tier 2 threshold. All Tier 1 projects would be required to implement mandatory reductions required due to other legal authority (Level 1 reductions) such as AB 32, Title 24, or local policies and ordinances. With Level 1

reduction measures, qualifying Tier 1 projects would be considered less than significant without being required to demonstrate mitigation to zero.

In Concept 2B, the Tier 2 threshold would be quantitative, and quantified inventories would be required. Several quantitative threshold options are discussed below. A more comprehensive set of Level 2 mitigation would be required. If the project's emissions still exceed the Tier 2 threshold, an even more aggressive set of Level 3 mitigation measures would be required including offsets (when feasible) to reduce emissions below the Tier 2 threshold.

In Concept 2C, there would be two thresholds, a lower Tier 2 threshold (the "low bar") and a higher Tier 3 threshold (the "high bar"). The Tier 2 threshold would be the significance threshold for the purposes of CEQA and would be qualitative in terms of units (number of dwelling units, square feet of commercial space, etc.) or a per capita ratio. Projects above the Tier 2 threshold would be required to implement the comprehensive set of Level 2 mitigation. Projects below the Tier 2 threshold would not be required to quantify emissions or reductions. The Tier 3 threshold would be a threshold to distinguish the larger set of projects for which quantification of emissions would be required. Level 3 mitigation would be required and the project would be required to purchase offsets (when feasible) in the amount of 90 percent of the net emissions after application of Level 1 reductions and Level 2 and 3 mitigation. A variant on Concept 2C would be to require mandatory Level 3 mitigation without quantification and offsets.

Approach 2 Threshold Options

Seven threshold options were developed for this approach. The set of options are framed to capture different levels of new development in the CEQA process and thus allow different levels of mitigation. Options range from a zero first-tier threshold (Threshold 2.1) up to a threshold for GHG that would be equivalent to the capture level (i.e., number of units) of the current criteria pollutant thresholds used by some air districts (Threshold 2.4). The decision-based implementation approach discussed above could be used for any of these options. Table 3 below compares the results of each of the approaches discussed here.

Threshold 2.1: Zero First Tier Tiered Threshold.

This option would employ the decision tree concept and set the first tier cut-point at zero. The second tier cut-point could be one of the qualitative or quantitative thresholds discussed below. First-tier projects would be required to implement a list of very feasible and readily available mitigation measures.

Threshold 2.2: Quantitative Threshold Based on Market Capture

A single quantitative threshold was developed in order to ensure capture of 90 percent or more of likely future discretionary developments. The objective was to set the emission

threshold low enough to capture a substantial fraction of future residential and non-residential development that will be constructed to accommodate future statewide population and job growth, while setting the emission threshold high enough to exclude small development projects that will contribute a relatively small fraction of the cumulative statewide GHG emissions.

The quantitative threshold was created by using the following steps:

- Reviewing data from four diverse cities (Los Angeles in southern California and Pleasanton, Dublin, and Livermore in northern California) on pending applications for development.

- Determining the unit (dwelling unit or square feet) threshold that would capture approximately 90 percent of the residential units or office space in the pending application lists.

- Based on the data from the four cities, the thresholds selected were 50 residential units and 30,000 square feet of commercial space.

- The GHG emissions associated with 50 single-family residential units and 30,000 square feet of office were estimated and were found to be 900 metric tons and 800 metric tons, respectively. Given the variance on individual projects, a single threshold of 900 metric tons was selected for residential and office projects.

- A 900 metric ton threshold was also selected for non-office commercial projects and industrial projects to provide equivalency for different projects in other economic sectors.

- If this threshold is preferred, it is suggested that a more robust data set be examined to increase the representativeness of the selected thresholds. At a minimum, a diverse set of at least 20 cities and/or counties from throughout the state should be examined in order to support the market capture goals of this threshold. Further, an investigation of market capture may need to be conducted for different commercial project types and for industrial projects in order to examine whether multiple quantitative emissions thresholds or different thresholds should be developed.

The 900-ton threshold corresponds to 50 residential units, which corresponds to the 84th percentile of projects in the City of Los Angeles, the 79th percentile in the City of Pleasanton, the 50th percentile in the City of Livermore and the 4th percentile in the City of Dublin. This is suggestive that the GHG reduction burden will fall on larger projects that will be a relatively small portion of overall projects within more developed central cities (Los Angeles) and suburban areas of slow growth (Pleasanton) but would be the higher portion of projects within moderately (Livermore) or more rapidly developing areas (Dublin). These conclusions are suggestive but not conclusive due to the small sample size. The proposed threshold would exclude the smallest proposed developments

from potentially burdensome requirements to quantify and mitigate GHG emissions under CEQA. While this would exclude perhaps 10 percent of new residential development, the capture of 90 percent of new residential development would establish a strong basis for demonstrating that cumulative reductions are being achieved across the state. It can certainly serve as an interim measure and could be revised if subsequent regulatory action by CARB shows that a different level or different approach altogether is called for.

The 900-ton threshold would correspond to office projects of approximately 35,000 square feet, retail projects of approximately 11,000 square feet, or supermarket space of approximately 6,300 square feet. 35,000 square feet would correspond to the 46th percentile of commercial projects in the City of Los Angeles, the 54th percentile in the City of Livermore, and the 35th percentile in the City of Dublin. However, the commercial data was not separated into office, retail, supermarket or other types, and thus the amount of capture for different commercial project types is not known. The proposed threshold would exclude smaller offices, small retail (like auto-parts stores), and small supermarkets (like convenience stores) from potentially burdensome requirements to quantify and mitigate GHG emissions under CEQA but would include many medium-scale retail and supermarket projects.

The industrial sector is less amenable to a unit-based approach given the diversity of projects within this sector. One option would be to adopt a quantitative GHG emissions threshold (900 tons) for industrial projects equivalent to that for the residential/commercial thresholds described above. Industrial emissions can result from both stationary and mobile sources. CARB estimates that their suggested reporting threshold for stationary sources of 25,000 metric tons accounts for more than 90 percent of the industrial sector GHG emissions (see Threshold 2.3 for 25,000 metric ton discussion). If the CARB rationale holds, then a 900 metric ton threshold would likely capture at least 90 percent (and likely more) of new industrial and manufacturing sources. If this approach is advanced, we suggest further examination of industrial project data to determine market capture.

This threshold would require the vast majority of new development emission sources to quantify their GHG emissions, apportion the forecast emissions to relevant source categories, and develop GHG mitigation measures to reduce their emissions.

Threshold 2.3: CARB Reporting Threshold

CARB has recently proposed to require mandatory reporting from cement plants, oil refineries, hydrogen plants, electric generating facilities and electric retail providers, cogeneration facilities, and stationary combustion sources emitting $\geq$ 25,000 MT CO_2e/yr. AB 32 requires CARB to adopt a regulation to require the mandatory reporting and verification of emissions. CARB issued a preliminary draft version of its proposed reporting requirements in August 2007 and estimates that it would capture 94 percent of the GHG emissions associated with stationary sources.

This threshold would use 25,000 metric tons per year of GHG as the CEQA significance level. CARB proposed to use the 25,000 metric tons/year value as a reporting threshold, not as a CEQA significance threshold that would be used to define mitigation requirements. CARB is proposing the reporting threshold to begin to compile a statewide emission inventory, applicable only for a limited category of sources (large industrial facilities using fossil fuel combustion).

A 25,000 metric ton significance threshold would correspond to the GHG emissions of approximately 1,400 residential units, 1 million square feet of office space, 300,000 square feet of retail, and 175,000 square feet of supermarket space. This threshold would capture far less than half of new residential or commercial development.

As noted above, CARB estimates the industrial-based criteria would account for greater than 90 percent of GHG emissions emanating from stationary sources. However, industrial and manufacturing projects can also include substantial GHG emissions from mobile sources that are associated with the transportation of materials and delivery of products. When all transportation-related emissions are included, it is unknown what portion of new industrial or manufacturing projects a 25,000-ton threshold would actually capture.

An alternative would be to use a potential threshold of 10,000 metric tons considered by the Market Advisory Committee for inclusion in a Greenhouse Gas Cap and Trade System in California. A 10,000 metric ton significance threshold would correspond to the GHG emissions of approximately 550 residential units, 400,000 square feet of office space, 120,000 square feet of retail, and 70,000 square feet of supermarket space. This threshold would capture roughly half of new residential or commercial development.

Threshold 2.4: Regulated Emissions Inventory Capture

Most California air districts have developed CEQA significance thresholds for NOx and ROG emissions to try to reduce emissions of ozone precursors from proposed sources that are not subject to NSR pre-construction air quality permitting. The historical management of ozone nonattainment issues in urbanized air districts is somewhat analogous to today's concerns with greenhouse gas emissions in that regional ozone concentrations are a cumulative air quality problem caused by relatively small amounts of NOx and ROG emissions from thousands of individual sources, none of which emits enough by themselves to cause elevated ozone concentrations. Those same conditions apply to global climate change where the environmental problem is caused by emissions from a countless number of individual sources, none of which is large enough by itself to cause the problem. Because establishment of NOx/ROG emissions CEQA significance thresholds has been a well-tested mechanism to ensure that individual projects address cumulative impacts and to force individual projects to reduce emissions under CEQA, this threshold presumes the analogy of NOx/ROG emission thresholds could be used to develop similar GHG thresholds.

The steps to develop a GHG emission threshold based on the NOx/ROG analogy were as follows:

- For each agency, define its NOx/ROG CEQA thresholds.
- For each agency, define the regional NOx/ROG emission inventory the agency is trying to regulate with its NOx/ROG thresholds.
- For each agency, calculate the percentage of the total emission inventory for NOx represented by that agency's CEQA emission threshold. That value represents the "minimum percentage of regulated inventory" for NOx.
- The current (2004) California-wide GHG emission inventory is 499 million metric tons per year of CO_2 equivalent (MMT CO_2e). Apply the typical "minimum percentage of regulated inventory" value to the statewide GHG inventory, to develop a range of analogous GHG CEQA thresholds.

The preceding methodology was applied to two different air quality districts: the Bay Area Air Quality Management District (BAAQMD), a mostly-urbanized agency within which most emissions are generated from urban areas; and the San Joaquin Valley Air Pollution Control District (SJVAPCD), which oversees emissions emanating in part from rural areas that are generated at dispersed agricultural sources and area sources. For example, in the Bay Area the NOx threshold is 15 tons/year. The total NOx inventory for 2006 was 192,000 tons/year (525 tons/day). The threshold represents 0.008 percent of the total NOx inventory. Applying that ratio to the total statewide GHG emissions inventory of 499 MMT CO_2e (2004) yields an equivalent GHG threshold of 39,000 MMT CO_2e.

The range of analogous CEQA GHG thresholds derived from those two agencies is tightly clustered, ranging from 39,000 to 46,000 tons/year. A 39,000 to 46,000 metric ton threshold would correspond to the GHG emissions of approximately 2,200 to 2,600 residential units, 1.5 to 1.8 million square feet of office space, 470,000 to 560,000 square feet of retail, and 275,000 to 320,000 square feet of supermarket space. This threshold would capture far less than half of new residential or commercial development. Similarly, this threshold would capture less of new industrial/manufacturing GHG emissions inventory than Thresholds 2.2 or 2.3.

Threshold 2.5: Unit-Based Thresholds Based on Market Capture

Unit thresholds were developed for residential and commercial developments in order to capture approximately 90 percent of future development. The objective was to set the unit thresholds low enough to capture a substantial fraction of future housing and commercial developments that will be constructed to accommodate future statewide population and job growth, while setting the unit thresholds high enough to exclude small development projects that will contribute a relatively small fraction of the cumulative statewide GHG emissions. Sector-based thresholds were created by using the same steps

and data used to create Threshold 2.2- Quantitative Threshold Based on Market Capture above.

The distribution of pending application data suggests that the GHG reduction burden will fall on larger projects that will be a relatively small portion of overall projects within more developed central cities and suburban areas of slow growth but would be the higher portion of projects within moderately or rapidly developing areas. The proposed threshold would exclude the smallest proposed developments from potentially burdensome requirements to quantify and mitigate GHG emissions under CEQA. While this would exclude perhaps 10 percent of new residential development, the capture of 90 percent of new residential development would establish a strong basis for demonstrating that cumulative reductions are being achieved across the state. It can certainly serve as an interim measure and could be revised if subsequent regulatory action by CARB shows that a different level or different approach altogether is called for.

A similar rationale can be applied to the development of a commercial threshold. Threshold 2.5 would exclude many smaller businesses from potentially burdensome requirements to quantify and mitigate GHG emissions under CEQA. It should be noted that the GHG emissions of commercial projects vary substantially. For example, the carbon dioxide emissions associated with different commercial types were estimated as follows:

- 30,000 square-foot (SF) office = 800 metric tons/year CO_2
- 30,000 SF retail = 2,500 metric tons/year CO_2
- 30,000 SF supermarket = 4,300 metric tons/year CO_2

Thus, in order to assure appropriate market capture on an emissions inventory basis, it will be important to examine commercial project size by type, instead of in the aggregate (which has been done in this paper).

The industrial sector is less amenable to a unit-based approach given the diversity of projects within this sector. One option would be to use a quantitative threshold of 900 tons for industrial projects in order to provide for rough equivalency between different sectors. Industrial emissions can result from both stationary and mobile sources. However, if the CARB rationale for > 90 percent stationary source capture with a threshold of 25,000 metric tons holds, then a 900 metric ton threshold would likely capture at least 90 percent (and likely more) of new industrial sources. Further examination of unit-based industrial thresholds, such as the number of employees or manufacturing floor space or facility size, may provide support for a unit-based threshold based on market capture.

This threshold would require the vast majority of new development emission sources to quantify their GHG emissions, apportion the forecast emissions to relevant source categories, and develop GHG mitigation measures to reduce their emissions.

Threshold 2.6. Projects of Statewide, Regional, or Areawide Significance

For this threshold, a set of qualitative, tiered CEQA thresholds would be adopted based on the definitions of "projects with statewide, regional or areawide significance" under the Guidelines for California Environmental Quality Act, CCR Title 14, Division 6, Section 15206(b).

Project sizes defined under this guideline include the following:

- Proposed residential development of more than 500 dwelling units.
- Proposed shopping center or business establishment employing more than 1,000 persons or encompassing more than 500,000 square feet of floor space.
- Proposed commercial office building employing more than 1,000 persons or encompassing more than 250,000 square feet of floor space.
- Proposed hotel/motel development of more than 500 rooms.
- Proposed industrial, manufacturing or processing plant or industrial park planned to house more than 1,000 persons, or encompassing more than 600,000 square feet of floor space.

These thresholds would correspond to the GHG emissions of approximately 9,000 metric tons for residential projects, 13,000 metric tons for office projects, and 41,000 metric tons for retail projects. These thresholds would capture approximately half of new residential development and substantially less than half of new commercial development. It is unknown what portion of the new industrial or manufacturing GHG inventory would be captured by this approach.

Threshold 2.7 Efficiency-Based Thresholds

For this approach, thresholds would be based on measurements of efficiency. For planning efforts, the metric could be GHG emissions per capita or per job or some combination thereof. For projects, the metric could be GHG emission per housing unit or per square foot of commercial space. In theory, one could also develop metrics for GHG emissions per dollar of gross product to measure the efficiency of the economy.

This approach is attractive because it seeks to benchmark project GHG intensity against target levels of efficiency. The thresholds would need to be set such that there is reasonably foreseeable and sufficient reductions compared to business as usual to support meeting AB 32 and S-3-05 goals in time (in combination with command and control regulations). Because this approach would require substantial data and modeling to fully develop, this is a concept considered as a potential future threshold and not appropriate

for interim guidance in the short term. Thus, it is not evaluated in the screening evaluation in the next section.

Table 3 compares the results for each of the approaches.

Table 3: Comparison of Approach 2 Tiered Threshold Options

Threshold	GHG Emission Threshold (metric tons/year)	Future Development Captured by GHG Threshold
2.1: Zero Threshold	0 tons/year	All
2.2: Quantitative Threshold Based on Market Capture	~900 tons/year	Residential development > 50 dwelling units Office space > 36,000 ft^2 Retail space >11,000 ft^2 Supermarkets >6.300 ft^2 small, medium, large industrial
2.3: CARB GHG Mandatory Reporting Threshold OR Potential Cap and Trade Entry Level	25,000 metric tons/year OR 10,000 metric tons/year	Residential development >1,400 dwelling units OR 550 dwelling units Office space >1 million ft^2 OR 400,000 ft^2 Retail space >300,000 ft^2 OR 120,000 ft^2 Supermarkets >175,000 ft^2 OR 70,000 ft^2 medium/larger industrial
2.4: Regulated Inventory Capture	40,000 – 50,000 metric tons/year	Residential development >2,200 to 2,600 dwelling units Office space >1.5 to 1.8 million ft^2 Retail space >470,000 to 560,000 ft^2 Supermarkets >270,000 to 320,000 ft^2 medium/larger industrial
2.5: Unit-Based Threshold Based on Market Capture	Not applicable.	Residential development >50 dwelling units Commercial space >50,000 ft^2 > small, medium, large industrial (with GHG emissions > 900 tonsCO2e)
2.6: Projects of Statewide, Regional, or Areawide Significance	Not applicable.	Residential development >500 dwelling units Office space >250,000 ft^2 Retail space >500,000 ft^2 Hotels >500 units Industrial project >1,000 employees Industrial project >40 acre or 650,000 ft^2
2.7: Efficiency-Based Thresholds	TBD tons/year/person TBD tons/year/unit	Depends on the efficiency measure selected.

Implementing CEQA With Tiered Thresholds

Several issues related to Approach 2 are addressed below:

1. *Some applications of this approach may need to be embodied in a duly approved General Plan, or in some other formal regulation or ordinance to be fully enforceable.* Because CEQA does not expressly provide that projects may be deemed insignificant based on implementation of a set of mitigations, this approach may need to be supported with specific and enforceable mechanisms adopted with due public process.

2. *How would this concept affect adoption of air district rules and regulations?* Proposed air district rules and regulations may be subject to CEQA like other projects and plans. Thus, if significance thresholds were adopted by an APCD or AQMD, then they could also apply to air district discretionary actions. If GHG emissions would be increased by a rule or regulation for another regulated pollutant, that would be a potential issue for review under CEQA.

3. *Mitigation measures may not be all-inclusive; better measures now or new future technology would make these measures obsolete.* The mandatory mitigation measures could be periodically updated to reflect current technology, feasibility, and efficiency.

4. *Total reduction may not be quantified or difficult to quantify.* CEQA only requires the adoption of feasible mitigation and thus the reduction effectiveness of required mitigation should not be in question. However, the precise reduction effectiveness may indeed be difficult to identify. As described above, if a quantitative threshold is selected as the measure of how much mitigation is mandated, then best available evidence will need to be used to estimate resultant GHG emissions with mitigation adoption. If a qualitative threshold is selected, then it may not be necessary to quantify reductions.

5. *Difficult to measure progress toward legislative program goals.* One could require reporting of project inventories to the Climate Action Registry, air district, or regional council of governments, or other suitable body. Collection of such data would allow estimates of the GHG intensity of new development over time, which could be used by CARB to monitor progress toward AB 32 goals.

6. *Measures may have adverse impacts on other programs.* The identification of mandatory mitigation will need to consider secondary environmental impacts, including those to air quality.

7. *Consideration of life-cycle emissions.* In many cases, only direct and indirect emissions may be addressed, rather than life-cycle emissions. A project applicant has traditionally been expected to only address emissions that are closely related and within the capacity of the project to control and/or influence. The long chain

8. of economic production resulting in materials manufacture, for example, involves numerous parties, each of which in turn is responsible for the GHG emissions associated with their particular activity. However, there are situations where a lead agency could reasonably determine that a larger set of upstream and downstream emissions should be considered because they are being caused by the project and feasible alternatives and mitigation measures may exist to lessen this impact.

Approach 2 Tiered Threshold with Mandatory Mitigation

As shown in Table 2, due to the cumulative nature of GHG emissions and climate change impacts, there could be a level of mandatory reductions and/or mitigation for all projects integrated into a tiered threshold approach. In order to meet AB 32 mandates by 2020 and S-3-05 goals, there will need to be adoption of GHG reduction measures across a large portion of the existing economy and new development. As such, in an effort to support a determination under CEQA that a project has a less than considerable contribution to significant cumulative GHG emissions, mitigation could be required on a progressively more comprehensive basis depending on the level of emissions.

- Level 1 Reductions – These reduction measures would apply to all projects and would only consist of AB 32 and other local/state mandates. They would be applied to a project from other legal authority (not CEQA). Level 1 reductions could include such measures as bike parking, transit stops for planned routes, Energy Star roofs, Energy Star appliances, Title 24 compliance, water use efficiency, and other measures. All measures would have to be mandated by CARB or local regulations and ordinances.

- Level 2 Mitigation – Projects that exceed the determined threshold would be required to first implement readily available technologies and methodologies with widespread availability. Level 2 Mitigation could include such measures as: parking reduction below code minimum levels, solar roofs, LEED Silver or Gold Certification, exceed Title 24 building standards by 20 percent, Traffic Demand Management (TDM) measures, and other requirements.

- Level 3 Mitigation - If necessary to reduce emissions to the thresholds, more extensive mitigation measures that represent the top tier of feasible efficiency design would also be required. Level 3 Mitigation could include such measures as: on-site renewable energy systems, LEED Platinum certification, exceed Title 24 building requirements by 40 percent, required recycled water use for irrigation, zero waste/high recycling requirements, mandatory transit pass provision, and other measures.

- Offset Mitigation – If, after adoption of all feasible on-site mitigation, the project is still found to exceed a Tier 2 quantitative threshold, or exceed a Tier 3 qualitative threshold, or if a project cannot feasibly implement the mandatory on-site mitigation, then purchases of offsets could be used for mitigation. In the case

of a quantitative threshold, the amount of purchase would be to offset below the Tier 2 significance threshold. In the case of a qualitative threshold, the amount of purchase could be to offset GHG emissions overall to below the lowest equivalent GHG emissions among the Tier 2 qualitative thresholds. With Threshold 2.5, this would be approximately 900 tons of GHG emissions (corresponding to 50 residential units). With Threshold 2.6, this would be approximately 9,000 tons (corresponding to 500 residential units). Alternatively, one could require purchase of offsets in the amount of a set percentage (such as 90% or 50% for example) of the residual GHG emissions (after other mitigation). As discussed earlier, any decision to include or require the use of emission reduction credits (or offsets) must consider issues of availability, quality, and environmental justice.

Substantial Evidence Supporting Different Thresholds

If a project can be shown by substantial evidence not to increase GHG emissions relative to baseline emissions, then no fair argument will be available that the project contributes considerably to a significant cumulative climate change impact.

It is more challenging to show that a project that increases GHG emissions above baseline emissions does not contribute considerably to a significant cumulative climate change impact. It is critical therefore, to establish an appropriate cumulative context, in which, although an individual project may increase GHG emissions, broader efforts will result in net GHG reductions.

Approach 1-based thresholds that by default will require an equal level of GHG reductions from the existing economy (Thresholds 1.1, 1.3, and 1.4) may be less supportable in the short run (especially before 2012) than Approach 1.2 (which requires new development to be relatively more efficient than a retrofitted existing economy). This is because, prior to 2012, there will only be limited mandatory regulations implementing AB 32 that could address the existing economy in a truly systematic way that can be relied upon to demonstrate that overall GHG reduction goals can be achieved by 2020. Approach 1.2 will still rely on substantial reductions in the existing economy but to a lesser degree.

Approach 1-based thresholds that would spread the mitigation burden across a sector (Threshold 1.3) or across a region (Threshold 1.4) will allow for tradeoffs between projects or even between municipalities. In order to demonstrate that a sector or a region is achieving net reductions overall, there would need to be feasible, funded, and mandatory requirements in place promoting an overall reduction scheme, in order for a project to result in nominal net increased GHG emissions.

Approach 2-based thresholds that capture larger portions of the new development GHG inventory (Thresholds 2.2 and 2.5) would promote growth that results in a smaller increase in GHG emissions; they may therefore be more supportable than thresholds that do not and that have a greater reliance on reductions in the existing economy (Thresholds

2.3, 2.4, and 2.6), especially in the next three to five years. With an established cumulative context that demonstrates overall net reductions, all threshold approaches could be effective in ensuring growth and development that significantly mitigates GHG emissions growth in a manner that will allow the CARB to achieve the emission reductions necessary to meet AB 32 targets. In that respect, all of these thresholds are supported by substantial evidence.

Evaluation of Non-Zero Threshold Options

Overarching issues concerning threshold development are reviewed below. Where appropriate, different features or application of the two conceptual approaches and the various options for thresholds under each conceptual approach described above are analyzed. The screening evaluation is summarized in Tables 4 (Approach 1) and 5 (Approach 2). The summary tables rate each threshold for the issues discussed below based on the level of confidence (low, medium or high) ascribed by J&S. The confidence levels relate to whether a threshold could achieve a particular attribute, such as emission reduction effectiveness. For example, a low emission reduction effectiveness rating means the threshold is not expected to capture a relatively large portion of the new development inventory.

As described above, Threshold 2.7 is not included in this evaluation because the data to develop an efficiency-based threshold has not been reviewed at this time and because this threshold is not considered feasible as an interim approach until more detailed inventory information is available across the California economy.

What is the GHG Emissions Effectiveness of Different Thresholds?

Effectiveness was evaluated in terms of whether a threshold would capture a large portion of the GHG emissions inventory and thus require mitigation under CEQA to control such emissions within the larger framework of AB 32. In addition, effectiveness was also evaluated in terms of whether a threshold would require relatively more or less GHG emissions reductions from the existing economy verses new development. This is presumptive that gains from the existing economy (through retrofits, etc.) will be more difficult and inefficient relative to requirements for new development.

Approach 1-based thresholds that require equivalent reductions relative to business-as-usual (Thresholds 1.1, 1.3, and 1.4) for both the existing and new economy will be less effective than thresholds that support lower-GHG intensity new development (Approach 1.2). However, since Approach 1-based thresholds do not establish a quantitative threshold below which projects do not have to mitigate, the market capture for new development is complete.

Approach 2-based thresholds can be more or less effective at capturing substantial portions of the GHG inventory associated with new development depending on where the quantitative or qualitative thresholds are set. Lower thresholds will capture a broader range of projects and result in greater mitigation. Based on the review of project data for

the select municipalities described in the Approach 2 section above, thresholds based on the CARB Reporting Threshold/Cap and Trade Entry Level (Threshold 2.4) or CEQA definitions of "Statewide, Regional or Areawide" projects (Threshold 2.6) will result in a limited capture of the GHG inventory. Lower quantitative or qualitative thresholds (Thresholds 2.1, 2.2 and 2.5) could result in capture of greater than 90 percent of new development.

Are the Different Thresholds Consistent with AB 32 and S-3-05?

Thresholds that require reductions compared to business-as-usual for all projects or for a large portion of new development would be consistent with regulatory mandates. In time, the required reductions will need to be adjusted from 2020 (AB 32) to 2050 (S-3-05) horizons, but conceptually broad identification of significance for projects would be consistent with both of these mandates. Thresholds that exclude a substantial portion of new development would likely not be consistent, unless it could be shown that other more effective means of GHG reductions have already been, or will be adopted, within a defined timeframe.

All Approach 1-based thresholds would be consistent with AB 32 and S-3-05 if it can be demonstrated that other regulations and programs are effective in achieving the necessary GHG reduction from the existing economy to meet the overall state goals.

Approach 2-based thresholds that include substantive parts of the new development GHG inventory (Thresholds 2.1, 2.2 and 2.5) will be more consistent with AB 32 and S-3-05 than those that do not (Thresholds 2.3, 2.4, and 2.6) unless it can be demonstrated that other regulations and programs are effective in achieving the necessary GHG reduction from the existing economy to meet the overall state goals.

What are the Uncertainties Associated with Different Thresholds?

All thresholds have medium to high uncertainties associated with them due to the uncertainty associated with the effectiveness of AB 32 implementation overall, the new character of GHG reduction strategies on a project basis, the immaturity of GHG reduction technologies or infrastructure (such as widespread biodiesel availability), and the uncertainty of GHG reduction effectiveness of certain technologies (such as scientific debate concerning the relative lifecycle GHG emissions of certain biofuels, for example).

In general, Approach 1-based thresholds have higher uncertainties than Approach 2 thresholds because they rely on a constantly changing definition of business-as-usual. Threshold 1.2, with its relatively smaller reliance on the existing economy for GHG reductions has relatively less uncertainty than other Approach 1 thresholds. Thresholds that spread mitigation more broadly (Thresholds 1.3 and 1.4) have less uncertainty by avoiding the need for every project to mitigate equally.

Approach 2 thresholds with lower quantitative (2.1 and 2.2) or qualitative (2.5) thresholds will have uncertainties associated with the ability to achieve GHG reductions

from small to medium projects. Approach 2 thresholds with higher quantitative (2.3, 2.4) or qualitative (2.6) thresholds will have uncertainties associated with the ability to achieve relatively larger GHG reductions from the existing economy.

What are Other Advantages/Disadvantages of the Different Thresholds?

Thresholds with a single project metric (Thresholds 1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 2.5, and 2.6) will be easier to apply to individual projects and more easily understood by project applicants and lead agencies broadly. Thresholds that spread mitigation across sectors (1.3) or regions (1.4), while simple in concept, will require adoption of more complicated cross-jurisdictional reduction plans or evaluation of broad sector-based trends in GHG intensity reduction over time. Approach 1 options would require all projects to quantify emissions in order to determine needed reductions relative to business-as-usual (which will change over time as described above). Concepts that are unit-based (Threshold 2.5 and 2.6) will not result in thresholds that have equal amount of GHG emissions, and thus equity issues may arise.

Table 4: Non-Zero Threshold Evaluation Matrix – Approach 1

Approach 1	**1.1**	**1.2**	**1.3**	**1.4**
	28% - 33% Reduction from BAU by 2020 by Project	**50% Reduction from BAU by 2020 by Project**	**28% - 33% Reduction by 2020 by Sector**	**28% - 33% Reduction by 2020 by Region**
GHG Emissions Reduction Effectiveness	**Low** - Captures all new projects but relies on a high level of reductions from the existing economy.	**Medium** - Captures all new projects and has a more realistic level of reductions from the existing economy.	**Low** - Captures all new projects but relies on a high level of reductions from the existing economy.	**Low** - Captures all new projects but relies on a high level of reductions from the existing economy.
Economic Feasibility	**Low** - Some projects will not be able to afford this level of reduction without effective market-based mechanisms like offsets.	**Low** - Some projects will not be able to afford this level of reduction without effective market-based mechanisms like offsets.	**Medium** - Sectors as a whole will be better able to achieve reductions than individual projects.	**Low** - Some regions and newly developed areas may not be able to afford this level of reduction without effective market-based mechanisms like offsets.
Technical Feasibility	**Medium** - Some projects will not be able to achieve this level of reduction without effective market-based mechanisms like offsets	**Low** - Relatively larger set of projects will not be able to achieve this level of reduction without effective market-based mechanisms like offsets	**High** - Some projects will not be able to achieve this level of reduction without effective market-based mechanisms like offsets	**Medium** - Some regions and newly developed areas may not be able to afford this level of reduction without effective market-based mechanisms like offsets.
Logistical Feasibility	**Low** - Absent broader reductions strategies, each project may reinvent the wheel each time to achieve mandated reductions.	**Low** - Absent broader reductions strategies, each project may reinvent the wheel each time to achieve mandated reductions.	**Low** - Absent broader reductions strategies, each project may reinvent the wheel each time to achieve mandated reductions.	**Low** - Absent broader reductions strategies, each project may reinvent the wheel each time to achieve mandated reductions.
Consistency with AB-32 and S-03-05	**Medium** - Would require heavy reliance on command and control gains.	**High**	**Medium-High** - Would rely on command and control gains, but would allow sectoral flexibility.	**Medium-High** - Would rely on command and control gains, but would allow regional flexibility.
Cost Effectiveness	**Low** - Will require all types of projects to reduce the same regardless of the cost/ton of GHG reductions.	**Low** - Will require all types of projects to reduce the same regardless of the cost/ton of GHG reductions.	**Low/Medium** - Allows tradeoffs within sector between high and low cost reduction possibilities but not between sectors.	**Low/Medium** - Allows tradeoffs within region between high and low cost reduction possibilities, but not between regions.
Uncertainties	**High** - BAU changes over time. Ability to reduce GHG emissions from existing economy will take years to demonstrate. Ability to limit GHG emissions from other new development will take years to demonstrate.	**Medium/High** - BAU changes over time. Ability to limit GHG emissions from other new development will take years to demonstrate.	**High** - BAU changes over time. Ability to reduce GHG emissions from existing economy will take years to demonstrate. Ability to limit GHG emissions from other new development will take years to demonstrate.	**High** - BAU changes over time. Ability to reduce GHG emissions from existing economy will take years to demonstrate. Ability to limit GHG emissions from other new development will take years to demonstrate.
Other Advantages	Simple/easy to explain.	Simple/easy to explain.	Spreads mitigation broadly	Spreads mitigation broadly
Other Disadvantages	Requires all projects to quantify emissions.	Requires all projects to quantify emissions.	Requires all projects to quantify emissions.	Requires all projects to quantify emissions.

Table 5: Non-Zero Threshold Evaluation Matrix – Approach 2

Approach 2	2.1 **Zero Threshold**	2.2 **Quantitative (900 tons)**	2.3 **Quantitative CARB Reporting Threshold/Cap and Trade (25,000 tons/ 10,000 tons)**	2.4 **Quantitative Regulated Inventory Capture (~40,000 - 50,000 tons)**	2.5 **Qualitative Unit-Based Thresholds**	2.6 **Statewide, Regional or Areawide (CEQA Guidelines 15206(b)).**
GHG Emissions Reduction Effectiveness	**High** - Captures all sources.	**High** - Market capture at >90%. Captures diverse sources.	**Medium** - Moderate market capture.	**Low** - Low market capture.	**High** - Market capture at ~90%. Captures diverse sources; excl. smallest proj.	**Medium** - Moderate market capture. Excludes small and med. projects.
Economic Feasibility	**Low** - Early phases will be substantial change in BAU, esp. for smaller projects; may be infeasible to mitigate.	**Medium** - Early phases will be substantial change in BAU, esp. for smaller projects; may be infeasible to mitigate.	**High** - Large projects have greater ability to absorb cost.	**High** - Large projects have greater ability to absorb cost.	**Medium** - Early phases will be substantial change in BAU, esp. for smaller projects; may be infeasible to mitigate.	**High** - Large projects have greater ability to absorb cost.
Technical Feasibility	**Low** - Early phases will be substantial change in BAU, esp. for smaller projects; may be infeasible to mitigate.	**Medium** - Early phases will be substantial change in BAU, esp. for smaller projects; may be inefficient to mitigate.	**High** - Greater opportunities for multiple reduction approaches.	**High** - Greater opportunities for multiple reduction approaches.	**Medium** - Early phases will be substantial change in BAU, particularly for smaller projects may be inefficient to mitigate.	**High** - Greater opportunities for multiple reduction approaches.
Logistical Feasibility	**Low** - Unless fee or offset basis,very difficult to mitigate all projects.	**Medium** - BMPs broadly written to allow diversity; new req. will take time to integrate into new dev.	**High** - Less mitigation.	**High** - Less mitigation.	**Medium** - BMPs broadly written to allow diversity; new req. will take time to integrate into new dev.	**High** - Less mitigation.
Consistency with AB-32 and S-03-05	**High** - Market capture.	**High** - Market capture at >90%.	**Low** - Would rely on command and control success heavily.	**Low** - Would rely on command and control success heavily.	**Medium** - Need to demonstrate adequate market capture over time.	**Low** - Would rely on command and control success heavily.
Cost Effectiveness	**Low** - Will result in inefficient mitigation approaches. Efficiency will improve in time.	**Medium** - Emphasis is on new dev., req. for mitigation will result in inefficient mitigation approaches in early phases. Efficiency will improve in time.	**Medium** - Relies on command and control reductions for existing economy more heavily. With focus on larger projects, eff. of mitigation for new dev. high.	**Medium** - Relies on command and control reductions for existing economy more heavily. With focus on larger projects, eff. of mitigation for new dev. high.	**Medium** - Emphasis is on new dev.; req. for mitigation will result in inefficient mitigation approaches in early phases. Efficiency will improve in time.	**Medium** - Relies on command and control reductions for existing economy more heavily. With focus on larger projects, eff. of mitigation for new dev. high.
Uncertainties	**High** - Time to adapt for res. and comm.. sectors. Ability to mitigate without market-based mechanism for smaller projects unlikely.	**Medium/High** - Time to adapt for res. and comm.. sectors. Ability to mitigate without market-based mechanism for smaller projects uncertain.	**High** - Gains from command and control likely longer to be realized.	**High** - Gains from command and control likely longer to be realized.	**Medium/High** - Time to adapt for res. and comm.. sectors. Ability to mitigate without market-based mechanism for smaller projects uncertain.	**High** - Gains from command and control likely longer to be realized.
Other Advantages	Single threshold.	Single threshold. BMPs can be updated. Greenlist can be updated.	Single threshold. Does not change CEQA processing for most projects. CARB inventory = project inv.. All projects treated same.	Single threshold. Does not change CEQA processing for most projects. Follows established SIP practice.	BMPs can be updated. Greenlist can be updated. Unit-Based thresholds can be updated.	Existing guideline. Does not change CEQA processing for most projects. Endorsed by Cal. Chapter of the APA.
Other Disadvantages	Requires all projects to quantify emissions.	Requires nearly all projects to quantify emissions.			Sectoral projects have different GHG emis. Only largest projects to quantify emis.	Sectoral projects have different GHG emissions.

Introduction

This chapter evaluates the availability of various analytical methods and modeling tools that can be applied to estimate the greenhouse gas emissions from different project types subject to CEQA. This chapter will also provide comments on the suitability of the methods and tools to accurately characterize a projects emissions and offer recommendations for the most favorable methodologies and tools available. Some sample projects will be run through the methodologies and modeling tools to demonstrate what a typical GHG analysis might look like for a lead agency to meet its CEQA obligations. The air districts retained the services of EDAW environmental consultants to assist with this effort.

Methodologies/Modeling Tools

There are wide varieties of discretionary projects that fall under the purview of CEQA. Projects can range from simple residential developments to complex expansions of petroleum refineries to land use or transportation planning documents. It is more probably than not, that a number of different methodologies would be required by any one project to estimate its direct and indirect GHG emissions. Table 10 contains a summary of numerous modeling tools that can be used to estimate GHG emissions associated with various emission sources for numerous types of project's subject to CEQA. The table also contains information about the models availability for public use, applicability, scope, data requirements and its advantages and disadvantages for estimating GHG emissions.

In general, there is currently not one model that is capable of estimating all of a project's direct and indirect GHG emissions. However, one of the models identified in Table 9 would probably be the most consistently used model to estimate a projects direct GHG emissions based on the majority of projects reviewed in the CEQA process. The Urban Emissions Model (URBEMIS) is designed to model emissions associated with development of urban land uses. URBEMIS attempts to summarize criteria air pollutants and CO_2 emissions that would occur during construction and operation of new development. URBEMIS is publicly available and already widely used by CEQA practitioners and air districts to evaluate criteria air pollutants emissions against air district-adopted significance thresholds. URBEMIS is developed and approved for statewide use by CARB. The administrative reasons for using URBEMIS are less important than the fact that this model would ensure consistency statewide in how CO_2 emissions are modeled and reported from various project types.

One of the shortfalls of URBEMIS is that the model does not contain emission factors for GHGs other than CO_2, except for methane (CH_4) from mobile-sources, which is converted to CO_2e. This may not be a major problem since CO_2 is the most important GHG from land development projects. Although the other GHGs have a higher global warming potential, a metric used to normalize other GHGs to CO_2e, they are emitted in far fewer quantities. URBEMIS does not calculate other GHG emissions associated with

off-site waste disposal, wastewater treatment, emissions associated with goods and services consumed by the residents and workers supported by a project. Nor does URBEMIS calculate GHGs associated with consumption of energy produced off-site. (For that matter, URBEMIS does not report criteria air pollutant emissions from these sources either).

Importantly, URBEMIS does not fully account for interaction between land uses in its estimation of mobile source operational emissions. Vehicle trip rates are defaults derived from the Institute of Transportation Engineers trip generation manuals. The trip rates are widely used and are generally considered worst-case or conservative. URBEMIS does not reflect "internalization" of trips between land uses, or in other words, the concept that a residential trip and a commercial trip are quite possibly the same trip, and, thus, URBEMIS counts the trips separately. There are some internal correction settings that the modeler can select in URBEMIS to correct for "double counting"; however, a project-specific "double-counting correction" is often not available. URBEMIS does allow the user to overwrite the default trip rates and characteristics with more project-specific data from a traffic study prepared for a project.

Residential, Commercial, Mixed-Use Type Projects/ Specific Plans

Direct Emissions

URBEMIS can be used to conduct a project-specific model run and obtain CO_2e emissions for area and mobile sources from the project, and convert to metric tons CO_2e. When a project-specific traffic study is not available, the user should consult with their local air district for guidance. Many air district staff are experienced practitioners of URBEMIS and can advise the lead agency or the modeler on how to best tailor URBEMIS default input parameters to conduct a project-specific model run. When a traffic study has been prepared for the project, the user must overwrite default trip length and trip rates in URBEMIS to match the total number of trips and vehicle miles traveled (VMT) contained in the traffic study to successfully conduct a project-specific model run. URBEMIS is recommended as a calculation tool to combine the transportation study (if available) and EMFAC emission factors for mobile-sources. Use of a project-specific traffic study gets around the main shortfall of URBEMIS: the lack of trip internalization. URBEMIS also provides the added feature of quantifying direct area-source GHG emissions.

Important steps for running URBEMIS

1. Without a traffic study prepared for the project, the user should consult with the local air district for direction on which default options should be used in the modeling exercise. Some air districts have recommendations in the CEQA guidelines.

2. If a traffic study was prepared specifically for the project, the following information must be provided:

a. Total number of average daily vehicle trips *or* trip-generation rates by land use type per number of units; and,

b. Average VMT per residential *and* nonresidential trip.

c. The user overwrites the "Trip Rate (per day)" fields for each land use in URBEMIS such that the resultant "Total Trips" and the "Total VMT" match the number of total trips and total VMT contained in the traffic study.

d. Overwrite "Trip Length" fields for residential and nonresidential trips in UBEMIS with the project-specific lengths obtained form the traffic study.

3. Calculate results and obtain the CO_2 emissions from the URBEMIS output file (units of tons per year [TPY]).

Indirect Emissions

URBEMIS does estimate indirect emissions from landscape maintenance equipment, hot water heaters, etc. URBEMIS does not however, provide modeled emissions from indirect sources of emissions, such as those emissions that would occur off-site at utility providers associated with the project's energy demands. The California Climate Action Registry (CCAR) Protocol v.2.2 includes methodology, which could be used to quantify and disclose a project's increase in indirect GHG emissions from energy use. Some assumptions must be made for electrical demand per household or per square foot of commercial space, and would vary based on size, orientation, and various attributes of a given structure. An average rate of electrical consumption for residential uses is 7,000 kilowatt hours per year per household and 16,750 kilowatt hours per thousand square feet of commercial floor space. Commercial floor space includes offices, retail uses, warehouses, and schools. These values have been increasing steadily over the last 20 years. Energy consumption from residential uses has increased due to factors such as construction and occupation of larger homes, prices of electricity and natural gas, and increased personal income allowing residents to purchase more electronic appliances. Commercial energy consumption is linked to factors such as vacancy rates, population, and sales.

The modeler will look up the estimated energy consumption for the project's proposed land uses under year of project buildout, or use the values given in the previous paragraph for a general estimate. The CCAR Protocol contains emission factors for CO_2, CH_4, and nitrous oxide. The "CALI" region grid serves most of the State of California. If a user has information about a specific utility provider's contribution from renewable sources, the protocol contains methodology to reflect that, rather than relying on the statewide average grid. The incremental increase in energy production associated with project operation should be accounted for in the project's total GHG emissions for inclusion in the environmental document.

The incremental increase in energy production associated with project operation should be accounted for in the project's total GHG emissions, but it should be noted that these emissions would be closely controlled by stationary-source control-based regulations and additional regulations are expected under AB 32. However, in the interest of disclosing project-generated GHG emissions and mitigating to the extent feasible, the indirect emissions from off-site electricity generation can be easily calculated for inclusion in the environmental document.

Example Project Estimates for GHG Emissions

Residential Project

Project Attributes:

- 68 detached dwelling units
- 15.9 acres
- 179 residents
- 0 jobs
- Located in unincorporated Placer County (PCAPCD jurisdiction)
- Analysis year 2009

As shown in Table 6, the project's direct GHG emissions per service population (SP) would be approximately 8 metric tons CO_2e/SP/year.

Table 6: Residential Project Example GHG Emissions Estimates

URBEMIS Output (Project Specific)	Metric Tons/Year CO_2e	Demographic Data	
Area-source emissions	251	Residents	179
Mobile-source emissions	1,044	Jobs	0
Indirect emissions (from CCAR Protocol)	174		
Total operational emissions	**1,469**	Service population	179
Operational emissions/SP	**8.2**		

Notes:
CO_2e = carbon dioxide equivalent; CCAR = California Climate Action Registry; SP = service population(see definition of service population below in discussion of Normalization/Service Population Metric).

Sources: EDAW 2007, ARB 2007b, CCAR 2007, CEC 2000

Commercial Project

Project Attributes:

- Free Standing Discount Superstore: 241 thousand square feet (ksf)
- 0 residents

- 400 jobs
- Located in the San Joaquin Valley Air Pollution Control District's (SJVAPCD) jurisdiction
- Analysis year 2009

Table 7: Commercial Project Example GHG Emissions Estimates

URBEMIS Output (Project Specific)	Metric Tons/Year CO_2e	Demographic Data	
Area-source emissions	464	Residents	0
Mobile-source emissions	13,889	Jobs	400
Indirect emissions (from CCAR Protocol)	1,477		
Total operational emissions	**15,830**	Service population	400
Operational emissions/SP	**39.6**		

Notes:
CO_2e = carbon dioxide equivalent; CCAR = California Climate Action Registry; SP = service population (see definition of service population below in discussion of Normalization/Service Population Metric).

Sources: EDAW 2007, ARB 2007b, CCAR 2007, CEC 2000

Specific Plan

If used traditionally with default trip rates and lengths, rather than project-specific (Traffic Analysis Zone-specific) trip rates and lengths, URBEMIS does not work well for specific plan or general plan-sized projects with multiple land use types proposed. However, in all instances, projects of these sizes (several hundred or thousand acres) would be accompanied by a traffic study. Thus, for large planning-level projects, URBEMIS can be used as a calculation tool to easily obtain project-specific mobile-source emissions. The user should follow the steps discussed above; wherein he/she overwrites the default ITE trip rates for each land use type with that needed to make total VMT match that contained in the traffic study. The URBEMIS interface is a simple calculator to combine the traffic study and EMFAC emissions factors for mobile-source CO_2.

Project Attributes:

- 985 acres
- Total dwelling units: 5,634
- Commercial/Mixed Use: 429 ksf
- Educational: 2,565 ksf
- 14,648 residents
- 3,743 jobs
- Located in Sacramento County (SMAQMD jurisdiction)
- Analysis year 2009

Table 8: Specific Plan Example GHG Emissions Estimates

URBEMIS Output (Project Specific)	Metric Tons/Year CO_2e	Demographic Data	
Area-source emissions	23,273	Residents	14,648
Mobile-source emissions	73,691	Jobs	3,743
Indirect emissions (from CCAR Protocol)	32,744	Service population	18,391
Total operational emissions	**129,708**		
Operational emissions/SP	**7.1**		

Notes:
CO_2e = carbon dioxide equivalent; CCAR = California Climate Action Registry; SP = service population (see definition of service population below in discussion of Normalization/Service Population Metric).

Sources: EDAW 2007, ARB 2007b, CCAR 2007, CEC 2000

The specific plan example, when compared to the residential or commercial examples, illustrates the benefit of a mixed-use development when you look at CO_2e emissions per resident or job (service population) metric (see definition of service population below in discussion of Normalization/Service Population Metric). Though this particular specific plan is not an example of a true jobs/housing balance, the trend is clear: accommodating residents and jobs in a project is more efficient than residents or jobs alone.

Stationary- and Area-Source Project Types

GHG emissions from stationary or area sources that require a permit to operate from the air district also contain both direct and indirect sources of emissions. Examples of these types of sources would be fossil fuel power plants, cement plants, landfills, wastewater treatment plants, gas stations, dry cleaners and industrial boilers. All air districts have established procedures and methodologies for projects subject to air district permits to calculate their regulated pollutants. It is anticipated that these same procedures and methodologies could be extended to estimate a permitted facility's GHG calculations. For stationary and area sources that do not require air district permits, the same methodologies used for permitted sources could be used in addition to URBEMIS and CCAR GRP to calculate GHG emissions from these facilities.

Wastewater Treatment Facilities

Direct GHG emissions associated with a proposed waste water treatment plant can be calculated using AP-42 emission factors from Chapter 4.3.5 Evaporative Loss Sources: Waste Water-Greenhouse Gases and the CCAR methodology. In general, most wastewater operations recover CH_4 for energy, or use a flare to convert the CH_4 to CO_2. There are many types of wastewater treatment processes and the potential for GHG emissions from different types of plants varies substantially. There is not one standard set of emission factors that could be used to quantify GHG emissions for a state

"average" treatment plant. Thus, research will need to be conducted on a case-by-case basis to determine the "Fraction Anaerobically Digested" which is a function of the type of treatment process. Indirect emissions from these facilities can be calculated using the CCAR energy use protocols and URBEMIS model for transportation emissions.

Solid Waste Disposal Facilities

Air districts will have emission estimate methodologies established for methane emissions at permitted landfills. In addition, EPA's Landfill Gas Emissions Model (LandGem) and the CCAR methodology could also be used to quantify GHG emissions from landfill off gassing; however, this model requires substantial detail be input. The model uses a decomposition rate equation, where the rate of decay is dependent on the quantity of waste in place and the rate of change over time. This modeling tool is free to the public, but substantial project detail about the operation of the landfill is needed to run the model. Indirect emissions from these facilities can be calculated using the CCAR energy use protocols and URBEMIS model for transportation emissions.

Construction Emissions

GHG emissions would occur during project construction, over a finite time. In addition, a project could result in the loss of GHG sequestration opportunity due primarily to the vegetation removed for construction. URBEMIS should be used to quantify the mass of CO_2 that would occur during the construction of a project for land development projects. Some construction projects would occur over an extended period (up to 20–30 years on a planning horizon for general plan buildout, or 5–10 years to construct a dam, for example). OFFROAD emission factors are contained in URBEMIS for CO_2 emissions from construction equipment. For other types of construction projects, such as roadway construction projects or levee improvement projects, SMAQMD's spreadsheet modeling tool, the Road Construction Emissions Model (RoadMod), should be used. This tool is currently being updated to include CO_2 emissions factors from OFFROAD.

The full life-cycle of GHG emissions from construction activities is not accounted for in the modeling tools available, and the information needed to characterize GHG emissions from manufacture, transport, and end-of-life of construction materials would be speculative at the CEQA analysis level. The emissions disclosed will be from construction equipment and worker commutes during the duration of construction activities. Thus, the mass emissions in units of metric tons CO_2e/year should be reported in the environmental document as new emissions.

General Plans

In the short-term, URBEMIS can be used as a calculation tool to model GHG emissions from proposed general plans, but only if data from the traffic study is incorporated into model input. The same methodology applied above in the specific plan example applies to general plans. The CCAR GRP can be used to approximate indirect emissions from

increased energy consumption associated with the proposed plan area. The same models and methodologies discussed previously for wastewater, water supply and solid waste would be used to estimate indirect emissions resulting from buildout of the general plan.

In the longer-term, more complex modeling tools are needed, which would integrate GHG emission sources from land use interaction, such as I-PLACE^{3}S or CTG Energetics' Sustainable Communities Custom Model attempt to do. These models are not currently available to the public and only have applicability in certain areas of the state. It is important that a tool with statewide applicability be used to allow for consistency in project treatment, consideration, and approval under CEQA.

Scenarios

At the general plan level, the baseline used for analyzing most environmental impacts of a general plan update is typically no different from the baseline for other projects. The baseline for most impacts represents the existing conditions, normally on the date the Notice of Preparation is released. Several comparative scenarios could be relevant, depending on the exact methodological approach and significance criteria used for GHG assessment:

- Existing Conditions. The GHG emissions associated with the existing, on-the-ground conditions within the planning area.

- 1990 conditions. The GHG emissions associated with the general plan area in 1990. This is relevant due to the state's AB 32 GHG emission reduction goals' benchmark year of 1990. The GHG-efficiency of 1990 development patterns could be compared to that of the general plan buildout.

- Buildout of the Existing General Plan. The GHG emissions associated with buildout of the existing general plan (without the subject update). This is the no project alternative for the purposes of general plan CEQA analysis.

- Buildout of the Updated General Plan. The GHG emissions associated with buildout of the general plan, as proposed as a part of the subject update. This would include analysis of any changes included as a part of the general plan update for the existing developed portions of the planning area. Many communities include redevelopment and revitalization strategies as a part of the general plan update. The general plan EIR can include assumptions regarding what level and type of land use change could be facilitated by infill and redevelopment. Many jurisdictions wish to provide future projects consistent with these land use change assumptions with some environmental review streamlining. In addition, many communities include transit expansions, pedestrian/bicycle pathway improvements, multi-modal facility construction, travel demand policies, energy efficiency policies, or other measures that could apply to the existing developed area, just as they may apply to any new growth

areas. Such policies could affect the overall GHG emissions of the built out general plan area.

- Increment between Buildout of Updated General Plan and Existing General Plan Area. There are many important considerations associated with the characterization of the impact of the General Plan update. The actual GHG emissions impact could be described as the difference between buildout under the existing and proposed land use plan (No-Build Alternative). However, the courts have held that an EIR should also analyze the difference between the proposed General Plan and the existing environment (*Environmental Planning & Information Council v. County of El Dorado* (EPIC) (1982) 131 Cal.App.3d 350). At the General Plan level, over the course of buildout, some new land uses are introduced, which could potentially add operational GHG emissions and potentially remove existing sequestration potential. Some properties become vacant and are not redeveloped. Other properties become vacant and then are redeveloped. Communities cannot pretend to understand fully in advance each component of land use change. The programmatic document is the preferred method of environmental analysis. Through this programmatic framework, communities develop buildout assumptions as a part of the General Plan that are normally used as a basis of environmental analysis. For certain aspects of the impact analysis, it becomes important not just to understand how much "new stuff" could be accommodated under the updated General Plan, but also the altered interactions between both "new" and "existing" land uses within the planning area. As addressed elsewhere, there are tools available for use in understanding land use/transportation interactions at the General Plan level. Without the GHG targets established by AB 32, a simple mass comparison of existing conditions to General Plan buildout might be appropriate.

However, within the current legal context, the GHG efficiency of the updated General Plan becomes the focus of analysis. Some options in this regard include:

- Estimate the GHG emissions associated with all the land uses included within the planning area upon buildout of the General Plan using no project specific information (regional, countywide, or statewide defaults). Estimate GHG emissions using project specific information from the transportation engineer, transportation demand policies, community design elements, energy efficiency requirements, wastewater treatment and other public infrastructure design changes, and other components. Compare these two calculations. Is the second calculation reduced by the percent needed to meet AB 32 goals compared to the first calculation?

- Estimate the GHG emissions associated with the 1990 planning area and the per-capita or per-service population GHG associated with the 1990 planning area. (Many communities are establishing GHG inventories using different tools). Estimate the GHG emissions associated with buildout of the proposed General Plan update and the resulting per-capita or per-service population GHG

emissions. Compare the two calculations. Is the General Plan buildout per-capita or per-service population level greater than the 1990 estimate?

Example General Plan Update: Proposed new growth area

Project Attributes:

- 10,050 single family dwelling units
- 652 multi-family dwelling units
- 136 acres parks
- 2,047 ksf commercial (regional shopping center)
- 2,113 ksf office
- 383 acres industrial park
- 31,293 new residents
- 4,945 new jobs
- Located in Stanislaus County (SJVAPCD jurisdiction)
- Analysis year 2025

Table 9: General Plan Example GHG Emissions Estimates

URBEMIS Output (Project Specific)	**Metric Tons/Year CO_2e**	**Demographic Data**	
Construction emissions	12,083*	Residents	31,293
Area-source emissions	45,708		
Mobile-source emissions	263,954	Jobs	4,945
Indirect emissions (from CCAR Protocol)	78,385		
Total operational emissions	**388,046**	Service population	36,238
Operational emissions/SP	**10.7**		

* Approximately 241,656 metric tons CO_2e total at general plan buildout (assumes 20-year buildout period). Construction emissions were not included in total operational emissions.
Notes:
CO_2e = carbon dioxide equivalent; CCAR = California Climate Action Registry; SP = service population (see definition of service population below in discussion of Normalization/Service Population Metric).
Sources: EDAW 2007, ARB 2007b, CCAR 2007, CEC 2000

Due to the programmatic level of analysis that often occurs at the general plan level, and potential for many relevant GHG emission quantities, it could be preferable to use a qualitative approach. Such an analysis could address the presence of GHG-reducing policy language in the general plan.

Three possible tiers of approaches to addressing GHG mitigation strategies, either as general plan policy, general plan EIR mitigation measures, or both, include:

- Forward planning
- Project toolbox
- Defer to GHG reductions plan

The three basic approaches are described below.

1. Bring reduction strategies into the plan itself. The most effective way for local jurisdictions to achieve GHG emissions reductions in the medium- and long-term is through land use and transportation policies that are built directly into the community planning document. This involves creating land use diagrams and circulation diagrams, along with corresponding descriptive standards, that enable and encourage alternatives to travel and goods movement via cars and trucks. The land use and circulation diagrams provide a general framework for a community where people can conduct their everyday business without necessarily using their cars. The overall community layout expressed as a part of the land use and circulation diagrams is accompanied by a policy and regulatory scheme designed to achieve this community layout. Impact fees, public agency spending, regulations, administrative procedures, incentives, and other techniques are designed to facilitate land use change consistent with the communities' overall vision, as expressed in policy and in the land use diagram. There are many widely used design principles that can be depicted in land use and circulation diagrams and implemented according to narrative objectives, standards, and policies:

- Connectivity. A finely-connected transportation network shortens trip lengths and creates the framework for a community where homes and destinations can be placed close in proximity and along direct routes. A hierarchical or circuitous transportation network can increase trip lengths and create obstacles for walking, bicycling, and transit access. This policy language would likely be found in the Circulation Element.

- Compactness. Compact development, by its nature, can increase the efficiency of infrastructure provision and enable travel modes other than the car. If communities can place the same level of activity in a smaller space, GHG emissions would be reduced concurrently with VMT and avoid unnecessary conversion of open space. This policy language would likely be found in the Land Use Element.

- Diversity. Multiple land use types mixed in proximity around central "nodes" of higher-activity land uses can accommodate travel through means other than a car. The character and overall design of this land use mix is, of course, different from community to community. This policy language would likely be found in the Land Use Element.

- Facilities. Pedestrian, bicycle, and public transportation improvements, planning, and programming are sometimes an afterthought. To get a more GHG-efficient mode share, safe and convenient bike lanes, pedestrian pathways, transit shelters, and other facilities are required to be planned along with the vehicular travel network. This policy language would likely be found in the Circulation Element.

- Redevelopment. One way to avoid GHG emissions is to facilitate more efficient and economic use of the lands in already-developed portions of a community. Reinvestment in existing neighborhoods and retrofit of existing buildings is appreciably more GHG efficient than greenfield development, and can even result in a net reduction in GHG emissions. This policy language would likely be found in the Conservation or Land Use Element.

- Housing and Employment. Most communities assess current and future economic prospects along with long-range land use planning. Part of the objective for many communities is to encourage the coalescence of a labor force with locally available and appropriate job opportunities. This concept is best known as "jobs-housing balance." This policy language would likely be found in the Housing Element.

- Planning Level Versus Project Level. For transportation-related GHG emissions that local governments can mitigate through land use entitlement authority, the overall community land use strategy and the overall transportation network are the most fruitful areas of focus. The reduction capacity of project-specific mitigation measures is greatly limited if supportive land use and transportation policies are lacking at the community planning level. The regional economic context, of course, provides an important backdrop for land use and transportation policy to address GHG emissions. Within this context, the general plan is the readily available tool for local governments to establish such land use and transportation strategies. This policy language would likely be found in the Land Use and Circulation Elements.

- Shipping Mode Shift. Locate shipping-intensive land uses in areas with rail access. Some modes of shipping are more GHG-intensive than others. Rail, for example, requires only about 15 to 25 percent of the energy used by trucks to ship freight equivalent distances and involves reduced transportation-related GHG emissions. Cities and counties have little direct control over the method of shipment that any business may choose. Nevertheless, as a part of the general planning process, cities and counties can address constraints on the use of rail for transporting goods. This policy language would likely be found in the Land Use and Circulation Elements.

2. Provide a "toolbox" of strategies after the project site has been selected. In addition to the examples of design principles that are built into the community planning process, communities can offer project applicants a range of tools to reduce GHG emissions. Mitigation strategies are elaborated in detail in Chapter 9.

3. Defer to General Plan implementation measure. Develop and implement a GHG Emissions Reduction Plan. Another option for local governments would be development of an implementation measure as a part of the general plan that outlines an enforceable GHG reduction program. Perhaps the most well known example of this approach is the result of California's Attorney General settlement of the lawsuit brought against San

Bernardino County. The County has agreed to create a 1990 GHG inventory and develop measures to reduce such emissions according to the state's overall goals. Other communities have pursued similar programs (i.e., the City of San Diego, Marin County). Along with the inventories, targets, and example reduction measures, these programs would include quantitative standards for new development; targets for reductions from retrofitting existing development; targets for government operations; fee and spending program for GHG reduction programs; monitoring and reporting; and other elements. The local government itself should serve as a model for GHG reduction plan implementation, by inventorying emissions from government operations and achieving emission reductions in accordance with the plan's standards. An optional climate change element could be added to contain goals, policies, and this implementation strategy, or this could belong in an optional air quality element.

Other Project Types

Air District Rules, Regulations and Air Quality Plans

Air district air quality plans, rules and regulations could have the potential to increase or decrease GHG emissions within their respective jurisdiction. In general, air district air quality plans, rules and regulations act to reduce ozone precursors, criteria air pollutant and toxic air contaminant emissions, which would almost always act to reduce GHG emissions simultaneously. However, this may not always be the case.

Air Quality Plans

Air districts will have to include GHG emissions analysis as part of their criteria air pollutant and toxic air contaminant air pollutant analysis when considering the adoption of air quality plans and their subsequent rules and regulations needed to implement the plans. Multiple models and methodologies will be needed to accomplish this analysis.

Regional Transportation Plans

Regional transportation plans would also need to be evaluated on a case-by-case basis to determine if a net increase or decrease in GHG emissions would occur. Complex interactions between the roadway network, operating conditions, alternative transportation availability (such as public transit, bicycle pathways, and pedestrian infrastructure), and many other independent parameters specific to a region should be considered. Regional transportation models exist to estimate vehicular emissions associated with regional transportation plans, which includes the ability to estimate GHG emissions.

Normalization/Service Population Metric

The above methodology would provide an estimate of the mass GHG emissions generated by a proposed project, which could be compared to a mass emission threshold. EDAW developed a methodology that would measure a project's overall GHG efficiency

in order to determine if a project is more efficient than the existing statewide average for per capita GHG emissions. The following steps could be employed to estimate the GHG-"efficiency," which may be more directly correlated to the project's ability to help obtain objectives outlined in AB 32, although it relies on establishment of an efficiency-based significance threshold. The subcommittee believes this methodology may eventually be appropriate to evaluate the long-term GHG emissions from a project in the context of meeting AB 32 goals. However, this methodology will need substantially more work and is not considered viable for the interim guidance presented in this white paper.

- Divide the total operational GHG emissions by the Service Population (SP) supported by the project (where SP is defined as the sum of the number of residents and the number of jobs supported by the project). This value should be compared to that of the projected statewide GHG emissions inventory from the applicable end-use sectors (electricity generation, residential, commercial/institutional, and mobile-source) in 1990 divided by the projected statewide SP for the year 2020 (i.e., AB 32 requirements), to determine if the project would conflict with legislative goals.

    - If the project's operational GHG/SP falls below AB 32 requirements, then the project's GHG emissions are less than cumulatively considerable.

    - If the project's operational GHG/SP exceed AB 32 requirements (a substantial contribution), then the project's GHG emissions would conflict with legislative requirements, and the impact would be cumulatively considerable and mitigation would be required where feasible.

- New stationary and area sources/facilities: calculate GHG emissions using the CCAR GRP. All GHG emissions associated with new stationary or area sources should be treated as a net increase in emissions, and if deemed significant, should be mitigated where feasible.

- Road or levee construction projects or other construction-only projects: calculate GHG emissions using the RoadMod, which will be updated to contain GHG emission factors from EMFAC and OFFROAD. All construction-generated GHG emissions should be treated as a net increase, and if deemed significant, should be mitigated to the extent feasible.

- Air District rulemaking or air quality management plan-type projects should be evaluated on a case-by-case basis for secondary impacts of increased GHG emissions generation. In most cases, the types of projects that act to reduce regional air pollution simultaneously act to reduce GHG emissions, and would be beneficial, but should be evaluated for secondary effects from GHG emissions.

- Regional transportation plans should also be evaluated on a case-by-case basis for potential to either reduce or increase GHG emissions from the transportation sector. EMFAC can be utilized to determine the net change in GHG emissions

associated with projected vehicle VMT and from operating speed changes associated with additional or alleviated congestion.

To achieve the goals of AB 32, which are tied to GHG emission rates of specific benchmark years (i.e., 1990), California would have to achieve a lower rate of emissions per unit of population and per unit of economic activity than it has now. Further, in order to accommodate future population and economic growth, the state would have to achieve an even lower rate of emissions per unit than was generated in 1990. (The goal to achieve 1990 quantities of GHG emissions by 2020 means that this will need to be accomplished in light of 30 years of population and economic growth in place beyond 1990.) Thus, future planning efforts that would not encourage new development to achieve its fair share of reductions in GHG emissions would conflict with the spirit of the policy decisions contained in AB 32, thus impeding California's ability to comply with the mandate.

Thus, if a statewide context for GHG emissions were pursued, any net increase in GHG emissions within state boundaries would be considered "new" emissions. For example, a land development project, such as a specific plan, does not necessarily create "new" emitters of GHG, but would theoretically accommodate a greater number of residents in the state. Some of the residents that move to the project could already be California residents, while some may be from out of state (or would 'take the place' of in-state residents who 'vacate' their current residences to move to the new project). Some may also be associated with new births over deaths (net population growth) in the state. The out-of-state residents would be contributing new emissions in a statewide context, but would not necessarily be generating new emissions in a global context. Given the California context established by AB 32, the project would need to accommodate an increase in population in a manner that would not inhibit the state's ability to achieve the goals of lower total mass of emissions.

The average net influx of new residents to California is approximately 1.4 percent per year (this value represents the net increase in population, including the net contribution from births and deaths). With population growth, California also anticipates economic growth. Average statewide employment has grown by approximately 1.1 percent over the last 15 years. The average percentage of population employed over the last 15 years is 46 percent. Population is expected to continue growing at a projected rate of approximately 1.5 percent per year through 2050. Long-range employment projection data is not available from the California Department of Finance (DOF) and can be extrapolated in different ways (e.g., linear extrapolation by percentage rate of change, percentage of population employed, mathematical series expansion, more complex extrapolation based on further research of demographic projections such as age distribution). Further study would be needed to refine accurate employment projections from the present to 2050. For developing this framework, employment is assumed to have a constant proportionate relationship with the state's population. The projected number of jobs is assumed to be roughly 46 percent of the projected population.

In light of the statewide context established by California law, consistency is most important for evaluating GHG emissions from projects. Thus, URBEMIS and the CCAR GRP are the recommended tools for quantification of GHG emissions from most project types in the short term. Over the long term, more sophisticated models that integrate the relationship between GHG emissions and land use, transportation, energy, water, waste, and other resources, and have similar application statewide would have better application to the problem, but may not currently be as accessible or as easily operable. I-PLACE^{3}S and CTG Energetics' Sustainable Communities Model (SCM) are two examples of such models that contain emission factors for GHGs, which could be refined to have applicability statewide and made available to CEQA practitioners. Other models are likely to be developed, given the importance of this issue.

Short-Term and Long-Term Methodologies

The following tools can be used to quantify a project's GHG emissions until tools that are more comprehensive become available statewide:

1. Land development projects: URBEMIS 2007 v. 9.2 and the CCAR GRP v. 2.2 (short-term); further development of I-PLACE^{3}S or CTG's Sustainable Communities Model (long-term).
2. New stationary and area sources/facilities: AP-42 Chapter 4.3, LandGem v. 3.02, and/or CCAR GRP v. 2.2.
3. Road or levee construction projects or other construction-only projects: RoadMod/OFFROAD 2007.

Ideally, I-PLACE^{3}S or CTG's Sustainable Communities Model would be expanded to apply to all regions of the state. These types of models use an integrated approach, which is the best approach for reasonably approximating the emissions that result from interaction between land uses, but neither is available to the public and would create consistency problems in reporting emissions from projects across the state if these were used today. However, a similar model with statewide applicability will likely be developed due to the importance of the issue.Table 10 Summary of Modeling Tools for Estimating GHG Emissions and Project Applicability

Table 10: Summary of Modeling Tools for GHG Emissions

Method/Tool Description	Availability	Applicability	Scope	Ease of Use	Data Input (Requirements and Guidance)	Data Output	Recommendation Comments	Advantages/ Disadvantages
URBEMIS 2007	*Public domain -Download (www.urbemis.com) free of charge*	*Land development and construction projects (construction, mobile- and area-source emissions)*	*Local*	*Fairly Easy*	*Land use information, construction and operational data and assumptions (e.g., jurisdiction, acres of land use type, year of operation, etc.)*	*Mobile-source Construction & Operational CO_2 (lb/day or tons/year)*	*-Recommended for land use development and construction projects -Also recommended for net change in land use (zoning changes)*	*-Does not quantify indirect emissions from energy consumption or other GHGs (except methane from mobile-sources) -Free, available to public, and applicable statewide -Widely used for assessment of other air quality impacts*
California Climate Action Registry General Reporting Protocol v. 2.2	*Public guidance document*	*Indirect emissions from land development projects, stationary- and area-source facilities regulated under AB 32*	*State*	*Easy*	*Energy consumption*	*CO_2e (Metric tons/year)*	*-Recommended for indirect emissions from energy consumption for land use development projects, and for new stationary- or area- sources to be regulated*	*-Contains emission factors for CH_4 and N_2O in addition to CO_2 -Does not contain emission factors broken down by utility provider (statewide average grid only)*
Clean Air and Climate Projection (CACP) Software	*Public agencies (members of ICLEI, NACAA, or similar)*	*Local governments used for emissions inventories*	*Local*	*N/A*	*Energy usage, waste generation/disposal transportation*	*CO_2e (tons/year)*	*-Recommended for inventories of local government entities activities (must be a member of affiliated agency or group)*	*-Not available to public*
CTG Sustainable Communities Model	*Custom model*	*Land development*	*Regional, scalable*	*N/A*	*Land use information, operational (mobile, energy, economic, infrastructure) assumptions*	*CO_2e (tons/year)*	*-An integrated and comprehensive modeling tool, but cannot obtain*	*-Not available to public*

Method/Tool Description	Availability	Applicability	Scope	Ease of Use	Data Input (Requirements and Guidance)	Data Output	Recommendation Comments	Advantages/ Disadvantages
I-PLACE^{3}S	*Access fee through local COG* *Only available for eight California counties*	*Land use change*	*Regional, scalable*	*Fairly Easy*	*Parcel information*	*CO_2 (lb/day or tons/year)*	*-Recommended for land use development projects and land use changes* *-Especially good for general plans*	*-Not freely available to public* *-Not applicable statewide* *-Actually provides insight into land use interaction* *-Can include very specific project attributes* *-Trip rates are from behavioral survey data, instead of ITE*
EMFAC 2007	*Public domain*	*On-road mobile-sources*	*Statewide, regional*	*Fairly Easy*	*Vehicle fleet information*	*CO_2 (grams/mile)*	*-Not recommended for most projects (URBEMIS preferred)* *-Could be used for certain Air District Rulemaking applications*	*-Can compare emissions based on speed-distribution* *-Emission factors contained in URBEMIS* *-Not a stand-alone model*
OFFROAD 2007	*Public domain*	*Off-road mobile sources (construction equipment)*	*Statewide, regional*	*Fairly Easy*	*Construction fleet information*	*CO_2 (lb/day)*	*-Not recommended (URBEMIS preferred)* *-could be used for certain Air District Rulemaking applications (re: construction equipment)*	*-Emission factors contained in URBEMIS*
RoadMod (to be updated to include CO_2)	*Public domain*	*Off-road and on-road mobile sources (construction equipment and material haul trucks)*	*Statewide*	*Easy*	*Construction information*	*CO_2 (lb/day or tons/project)*	*-Recommended for construction-only projects (linear in nature; i.e., levees, roads, pipelines)*	*-To be updated to support emissions factors from OFFROAD 2007*

Method/Tool Description	Availability	Applicability	Scope	Ease of Use	Data Input (Requirements and Guidance)	Data Output	Recommendation Comments	Advantages/ Disadvantages
DTIM	*Public domain*	*On-road mobile-sources*	*Statewide, regional*	*Difficult (consists of a series of three programs and requires input files from traffic and emissions modeling)*	*-EMFAC files* *-Traffic model output files (e.g., link, interzonal, and trip end data)* *-User options file* *-Optional files*	*CO_2 (tons/year)*	*-Not recommended*	*-Not updated to support EMFAC 2007 emission factors* *-Input files include output files from regional transportation models which more accurately reflect VMT*
Southeast Climate Change Partnership Spreadsheet Model (UK)	*Public domain http://www.climatesoutheast.org.uk/*	*UK Local government/ agencies/ organizations used for emissions inventories*	*Local, county, regional*	*Fairly easy*	*Energy usage, waste generation/disposal, transportation*	*CO_2 (tonnes/year)*	*-Not recommended for use in California, but could be a valuable source for building an applicable spreadsheet model*	*-Applicability for UK, but could be updated with CA-specific emission factors*
EPA AP-42; Evaporation Loss Sources Chapter 4.3.5	*Public reference document*	*GHG emissions from waste water treatment facilities*	*Facility level*	*Easy equation; substantial research needed to use*	*Biochemical oxygen demand (BOD) loading, Fraction anaerobically digested*	*CH4 (lb/year)*	*-Recommended for Publicly owned treatment works (POTW) projects*	*-Substantial research needed to determine the "fraction anaerobically digested" parameter, which is dependent on the type of treatment plant/process*
LandGem v. 3.02	*Public domain http://www.epa.gov/ttn/catc/dir1/landgem-v302.xls*	*GHG emissions from anaerobic decomposition associated with landfills*	*Facility Level*	*Moderate*	*Solid waste processing, year of analysis, lifetime of waste in place*	*CO_2, CH_4 (Mega grams/year)*	*-Recommended for landfill emissions*	*-Emission rates change dependent on years of decomposition, waste in place rates of change.* *-Complex decomposition rate equation, but good first approximation*

Method/Tool Description	Availability	Applicability	Scope	Ease of Use	Data Input (Requirements and Guidance)	Data Output	Recommendation Comments	Advantages/ Disadvantages
CARROT	*Registry members*	*Stationary source emissions, vehicle fleet mobile sources*	*Facility level*	*Moderate*	*Facility-specific information*	*All GHGs*	*-Recommended for reporting facilities under AB 32 and for indirect emissions from energy consumption (CCAR Protocol)*	*-Estimates all GHGs and normalizes to CO_2e* *-Not publicly available*

Notes:

GHG = greenhouse gas; AB = assembly bill; CO_2e = carbon dioxide equivalent; CH_4 = methane; N_2O = nitrous oxide; COG = council of governments ; ITE = Institute of Transportation Engineers; CCAR = California Climate Action Registry

Source: Data compiled by EDAW and the California Air Pollution Control Officers Association in 2007

Introduction

This chapter (and Appendix B) identifies existing and potential mitigation measures that could be applied to projects during the CEQA process to reduce a project's GHG emissions that would be identified using the analytical methodologies included in this white paper. The Subcommittee retained the services of EDAW to assist with this effort. EDAW performed a global search of mitigation measures currently in practice and under study that would reduce GHG emissions.

Table 16 (Appendix B) provides a brief description of each measure along with an assessment of their feasibility (from a standpoint of economical, technological, and logistical feasibility, and emission reduction effectiveness), and identifies their potential for secondary impacts to air quality. During the global search performed, EDAW also took note of GHG reduction strategies being implemented as rules and regulation (e.g., early action items under AB 32), which are summarized in Table 18 (Appendix C). It is important to note that though compliance with such would be required by regulation for some sources, such strategies may be applicable to other project and source types.

The recurring theme that echoes throughout a majority of these measures is the shift toward New Urbanism, and research has consistently shown that implementation of Neotraditional Development techniques reduces VMT and associated emissions. The material reviewed assessed reductions from transportation-related measures (e.g., bicycle, pedestrian, transit, and parking) as a single comprehensive approach to land use. This comprehensive approach focuses on development design criteria conducive to enhancing alternate modes of transportation, including transit, walking, and bicycling. Transportation Demand Management (TDM) programs are viewed as a mechanism to implement specific measures. TDM responsibilities may include offering incentives to potential users of alternative modes of transportation and monitoring and reporting mode split changes.

The comprehensive approach makes it more difficult to assess reductions attributable to each measure. Nevertheless, there is a strong interrelationship between many of the measures, which justifies a combined approach. Consider the relationship between bike parking nonresidential, bike parking residential, endtrip facilities, and proximity to bike path/bike lane measures. In reality, these measures combined act as incentives for one individual to bike to work, while implementation of a single measure without the others reduces effectiveness.

The global nature of GHG emissions is an important feature that enables unique mitigation: abatement. When designing a project subject to CEQA, the preferred practice is first to avoid, then to minimize, and finally to compensate for impacts. Where the impact cannot be mitigated on-site, off-site mitigation is often and effectively implemented in several resource areas, either in the form of offsetting the same impact or preserving the resource elsewhere in the region. Frequently, mitigation fee programs or funds are established, where the proponent pays into the program and fees collected

throughout the region or state are used to implement projects that, in turn, proportionately offset the impacts of the projects to the given resource. It may be more cost-effective to reduce as much GHG on-site as feasible (economically and technologically). Then the proponent would pay into a "GHG retrofit fund" to reduce equivalent GHG emissions off-site. In contrast to regional air pollutant offset programs such as the Carl Moyer Program, it matters greatly where reductions of ozone precursors occur, as ozone affects regional air quality. The GHG retrofit fund could be used to provide incentives to upgrade older buildings and make them more energy efficient. This would reduce demand on the energy sector and reduce stationary source emissions associated with utilities. This program has been successfully implemented in the United Kingdom where developments advertise "carbon neutrality." Of course, some GHG emissions occur associated with operation of the development, but the development would offset the remainder of emissions through off-site retrofit. Avoiding emissions that would otherwise continue to occur at existing development would be a unique opportunity for mitigation of GHG emissions. Reduction of GHG emissions also may have important side benefits including reduction of other forms of pollution.

Depending on the significance threshold concept adopted, projects subject to the CEQA process would either qualitatively or quantitatively identify the amount of GHG emissions associated with their project using the analytical methodologies identified in the previous chapter. The analysis would then apply the appropriate number of mitigation measures listed in Appendix B to their project to reduce their GHG emissions below the significance level. Calculating the amount of GHG emission reductions attributable to a given mitigation measure would require additional research. The examples below illustrate how a project would be mitigated using this approach.

Residential Project Example

Project Attributes:

- 68 detached dwelling units
- 15.9 acres
- Located in unincorporated Placer County PCAPCD jurisdiction)
- Assume URBEMIS defaults for a rural project in Placer County, in absence of a traffic study (This is contrary to the recommendations contained under Task 1; a traffic study is necessary to asses project-specific GHG emissions).
- Analysis year 2009

Table 11: Residential Project Example GHG Emissions Estimates with Mitigation

URBEMIS Output (Unmitigated)	Metric Tons/Year CO_2e	URBEMIS Output (Mitigated)	Metric Tons/Year CO_2e	Percent Reduction
Area-source emissions	252	Area-source emissions	215	14.6
Mobile-source emissions	1,047	Mobile-source emissions	916	12.5
Total direct operational emissions (area + mobile)	1,299	Total operational emissions (area + mobile)	1,131	12.9

Notes:
CO_2e = carbon dioxide equivalent

Sources: Data compiled by EDAW in 2007

Using URBEMIS 2007 and assuming the project would implement the mitigation measures listed below, yearly project-generated emissions of CO_2e would be reduced by approximately 13 percent. Implementation of the following mitigation measures is assumed:

- 100 housing units within one-half-mile radius of project's center, including this project's 68 residential units;
- provision of 80 jobs in the study area;
- retail uses present with one-half-mile radius of project's center;
- 10 intersections per square mile;
- 100% of streets with sidewalks on one side;
- 50% of streets with sidewalks on both sides;
- 30% of collectors and arterials with bike lanes, or where suitable, direct parallel routes exist;
- 15% of housing units deed restricted below market rate;
- 20% energy efficiency increase beyond Title 24; and
- 100% of landscape maintenance equipment electrically powered and electrical outlets in front and rear of units.

Example Project Methodology and Mitigation

Table 12 –Residential Projects Example Methodology and Mitigation

Source	Methodology	Mitigation
Direct Emissions		
Construction	URBEMIS (OFFROAD emission factors)	MM C-1→MM C-4
Mobile Sources	URBEMIS (EMFAC emission factors)	MM T-3→MM T-8, MM T-10→ MM T-14, MM T-16, MM T-19→ MM T-21 MM D-2→MM D-8, MM D-10→ MM D-15, MM D-17 MM S-1→MM S-2 MM M-1→MM M-2
Area Sources	URBEMIS	MM D-13→MM D-15, MM D-17 MM E-1→MM E-8, MM E-10, MM E-12→MM E-23 MM S-1→MM S-2 MM M-1→MM M-2
Indirect Emissions		
Energy Consumption	CCAR GRP & CEC	

Table 13 –Commercial Projects Example Methodology and Mitigation

Source	Methodology	Mitigation
Direct Emissions		
Construction	URBEMIS (OFFROAD emission factors)	MM C-1→MM C-4
Mobile Sources	URBEMIS (EMFAC emission factors)	MM T-1→MM T-2, MM T-4→ MM T-15, MM T-17→MM T-21 MM D-1→MM D-3, MM D-5→ MM D-6, MM D-10, MM D-12, MM D-14→MM D-17 MM E-24 MM S-1→MM S-2 MM M-1→MM M-2
Area Sources	URBEMIS	MM D-14→MM D-17 MM E-1, MM E-4→MM E-13, MM E-16→MM E-24 MM S-1→MM S-2 MM M-1→MM M-2
Indirect Emissions		
Energy Consumption	CCAR GRP & CEC	

Table 14 –Specific Plans Example Methodology and Mitigation

Source	Methodology	Mitigation
Direct Emissions		
Construction	URBEMIS (OFFROAD emission factors)	MM C-1→MM C-4
Mobile Sources	Short-term: URBEMIS (EMFAC emission factors). Long-term: I-PLACE^{3}S/CTG SCM	MM T-1→MM T-21 MM D-1→MM D-12, MM D-18→ MM D-19 MM E-24 MM S-1→MM S-2 MM M-1→MM M-2
Area Sources	Short-term: URBEMIS (EMFAC emission factors). Long-term: I-PLACE^{3}S/CTG SCM	MM D-13→MM D-19 MM E-1→MM E-24 MM S-1→MM S-2 MM M-1→MM M-2
Indirect Emissions		
Energy Consumption	Short-term: CCAR GRP & CEC. Long-term: I-PLACE^{3}S/CTG SCM	

General Plans

- Include a general plan policy to reduce emissions within planning area to a level consistent with legislative requirements.
- Implementation strategies include preparation of a GHG reduction plan.
- Projects consistent with a general plan could be responsible for complying with such a policy.

Table 15 –General Plans Example Methodology and Mitigation

Source	Methodology	Mitigation
Direct Emissions		
Construction	URBEMIS (OFFROAD emission factors).	MS G-1 MM G-15
Mobile Sources	Short-term: URBEMIS (EMFAC emission factors). Long-term: I-PLACE^{3}S/CTG SCM	MS G-1 MS G-2→MS C-7, MS G-9, MS G-12, MS-13→MS-14, MS-16→MS-23
Area Sources	Short-term: URBEMIS (EMFAC emission factors). Long-term: I-PLACE^{3}S/CTG SCM	MS G-1 MS G-8→MS C-11, MS G-134, MS G-12, MS-15, MS-17, MS-22
Indirect Emissions		
Energy Consumption	Short-term: CCAR GRP & CEC. Long-term: I-PLACE^{3}S/CTG SCM	

Other Project Types

Air District Rules and Regulations

Air district rules and regulations could have the potential to increase or decrease GHG emissions within the respective jurisdiction. In general, air district rules and regulations act to decrease criteria air pollutant or toxic air contaminant emissions, which would usually act to reduce GHG emissions simultaneously. However, this may not always be the case and air district rules and regulations could address emissions from a large variety of different source types. Reductions of GHG emissions associated with implementation of applicable mitigation, which could also vary greatly, would need to be evaluated on a case-by-case basis. However, once applicable mitigation measures are identified, percent reductions based on the best available research to date, such as those specified in Table 15, could be applied to determine mitigated emissions.

Air Quality Plans

Similarly to air district rules and regulations, air quality plans could have the potential to increase or decrease GHG emissions because of criteria air pollutant reduction strategies. In general, strategies implemented by air districts to reduce criteria air pollutants also act to reduce GHG emissions. However, this may not always be the case. Reductions of GHG emissions associated with implementation of applicable mitigation would need to be evaluated on a case-by-case basis. The methodology identified above for determining whether the strategies contained within the GHG reduction plan would adhere to the level specified in general plan policy could also be used to determine the reductions associated with CAP strategies.

Regional Transportation Plans

Regional transportation plans and reductions of GHG emissions associated with implementation of applicable mitigation would also need to be evaluated on a case-by-case basis to determine if a net increase or decrease in GHG emissions would occur. Complex interactions between the roadway network, operating conditions, alternative transportation availability (such as public transit, bicycle pathways, and pedestrian infrastructure), and many other independent parameters specific to a region should be considered. EMFAC 2007 can be used with VMT from the RTP to create an inventory of GHG emissions. Reductions associated with implementation of applicable measures contained in Table 16 could be accomplished by accounting for VMT reductions in the traffic model.

Many states, counties, and cities have developed policies and regulations concerning greenhouse gas emissions that seek to require or promote reductions in GHG emissions through standards for vehicle emissions, fuels, electricity production/renewables, building efficiency, and other means. However, we could only identify three public agencies in the United States that are considering formally requiring the analysis of greenhouse gas emissions and climate change for development projects during their associated environmental processes. There may be others, but they were not identified during research conducted during preparation of this paper.

The following is a summary of those three efforts.

Commonwealth of Massachusetts - MEPA Greenhouse Gas Emissions Policy and Protocol

The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) has determined that the phrase "damage to the environment" as used in the Massachusetts Environmental Policy Act (MEPA) includes the emission of greenhouse gases caused by projects subjects to MEPA Review. EEA has published a Greenhouse Gas Emissions Policy (GGEP) to fulfill the statutory obligation to take all feasible measurers to avoid, minimize or mitigate damage to the environment.

The GGEP concerns the following projects only:

- The Commonwealth or a state agency is the proponent;
- The Commonwealth or a state agency is providing financial assistance;
- The project is privately funded, but requires an Air Quality Permit from the department of Environmental Protection;
- The project is privately funded, but will generate:
    - 3,000 or more new vehicle trips per day for office projects;
    - 6,000 or more new vehicle trips per day for mixed use projects that are 25% or more office space; or
    - 10,000 or more new vehicle trips per day for other projects.

As a comparison, the trip generation amounts correspond as follows:

- 3,000 vehicle trips per day = approximately 250,000 square foot office development;
- 6,000 or more new vehicle trips per day for mixed use projects that are 25% or more office space = if 25% office space, then equivalent to approximately 130,000 square feet of office and either 100,000 square feet of retail or 450 single-family residential units or some combination thereof.
- 10,000 or more new vehicle trips per day = approximately 1,000 single family residential units or 250,000 square feet retail.

The draft policy states it is not intended to create a numerical GHG emission limit or a numerical GHG emissions reduction target, but rather to ensure that project proponents and reviewers have considered the GHG emissions impacts of their projects and taken all feasible means and measure to reduce those impacts.

The draft policy notes that some projects within these categories will have little or no greenhouse gas emission and the policy will not apply to such projects. EEA intends to identify in the scoping certificate whether a project falls within this *de minimis* exception.

The GGEP requires qualifying projects to do the following:

- to quantify their GHG emissions;
- identify measures to minimize or mitigate such emissions;
- quantify the reduction in emissions and energy savings from mitigation.

Emissions inventories are intended to focus on carbon dioxide, but analysis of other GHGs may be required for certain projects. EEA will require analysis of direct GGH emissions and indirect (electricity and transportation) emissions. The GGEP references the protocols prepared by the World Resource Institute as guidance for inventory preparation.

The policy is still in draft form, but the comment period closed on August 10, 2007.

King County, Washington - Executive Order on the Evaluation of Climate Change Impacts through the State Environmental Policy Act (SEPA)

On June 27, 2007, the King County Executive Ron Sims directed all King County Departments, as follows:

> *"…effective September 1, 2007 to require that climate impacts, including, but not limited to those pertaining to greenhouse gases, be appropriately identified and evaluated when such Departments are acting as the lead agency in reviewing the environmental impacts of private or public proposals pursuant to the State Environmental Policy Act".*

The Executive Order does not define what a "climate impact" is. Based on statements of the County Deputy Chief of Staff[*]

- County agencies will ask project proponents to supply information on transportation, energy usage and other impacts of proposed projects using the County's existing SEPA checklist.

[*] Marten Law Group: Environmental News, August 1, 2007, "King County (WA) First in Nation to Require Climate Change Impacts to be Considered During Environmental Review of New Projects".

- There is no current plan to require project proponents to take action to mitigate the impacts identifies.
- Development of emissions thresholds and mitigation requirements will be undertaken in connection with the County's upcoming 2008 update of its Comprehensive Plan.

Sacramento Metropolitan Air Quality Management District

The Sacramento Metropolitan Air Quality Management District released an interim guidance on addressing climate change in CEQA documents on September 6, 2007. While very general in nature, the District recommends that CEQA environmental documents include a discussion of anticipated GHG emissions during both the construction and operation phases of the project. This includes assessing the GHG emissions from projects (using readily available models) to determine whether a project may have a significant impact. If so, then the District recommends addressing all of the District's GHG mitigation measures (drawn from comments made by the California Attorney General) – with explanations on how the mitigation will be implemented or providing rationale for why a measure would be considered infeasible. The District provides assistance to agencies in their analysis of GHG emissions and the applicability of specific mitigation measures. The District's guidance can be found at: http://64.143.64.21/climatechange/ClimateChangeCEQAguidance.pdf

Mendocino Air Quality Management District – CEQA Guidelines

The Mendocino AQMD updated its "Guidelines for Use During Preparation of Air Quality Impacts in EIRs or Mitigated Negative Declarations" in May 2007. The guidelines call for preparing estimates of the increased emissions of air contaminations (including GHG) for projects.

The guidelines state that GHG emissions should be presumed to have a significant impact if CO emissions from District-approved modeling exceed either of the following:

- 80% of the level defined as significant for stationary sources in Regulation1, Rule 130 (s2) of the District (which is 550 lbs/day for CO, meaning a threshold of 440 lbs/day for CO for stationary sources); or
- levels established in District Regulation 1 Rule 130 (i2) for indirect sources (which is 690 lbs/day for CO for indirect sources).

If an average passenger vehicle emits 22 grams of CO/mile and 0.8 lb/mile of CO_2, then the 690-lb/day threshold for CO corresponds to approximately 11,400 lb/day CO_2 threshold for passenger vehicle-related emissions. If one assumes that the average passenger vehicle goes 12,500 miles/year (about 35 miles/day), then this is a threshold equivalent to about 420 vehicles. Using an average in California of about 1.77 vehicles/household, this would correspond to about 250 households/dwelling units.

Appendix A

Relevant Citations

Citations from the Public Resources Code (Division 13, §21000 et seq.) as amended through January 1, 2005.

Public Resources Code – Section 21004, MITIGATING OR AVOIDING A SIGNIFICANT EFFECT; POWERS OF PUBLIC AGENCY:

"In mitigating or avoiding a significant effect of a project on the environment, a public agency may exercise only those express or implied powers provided by law other than this division. However, a public agency may use discretionary powers provided by such other law for the purpose of mitigating or avoiding a significant effect on the environment subject to the express or implied constraints or limitations that may be provided by law."

Public Resources Code – Section 21082.2, SIGNIFICANT EFFECT ON ENVIRONMENT; DETERMINATION; ENVIRONMENTAL IMPACT REPORT PREPARATION:

(a) The lead agency shall determine whether a project may have a significant effect on the environment based on substantial evidence in light of the whole record.

(b) The existence of public controversy over the environmental effects of a project shall not require preparation of an environmental impact report if there is no substantial evidence in light of the whole record before the lead agency that the project may have a significant effect on the environment.

(c) Argument, speculation, unsubstantiated opinion or narrative, evidence which is clearly inaccurate or erroneous, or evidence of social or economic impacts which do not contribute to, or are not caused by, physical impacts on the environment, is not substantial evidence. Substantial evidence shall include facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts.

(d) If there is substantial evidence, in light of the whole record before the lead agency, that a project may have a significant effect on the environment, an environmental impact report shall be prepared.

(e) Statements in an environmental impact report and comments with respect to an environmental impact report shall not be deemed determinative of whether the project may have a significant effect on the environment.

Citations from the Guidelines for California Environmental Quality Act, CCR, Title 14, Division 6 (§15000 et seq.) as amended through July 27, 2007.

AG=Attorney General; ARB=California Air Resources Board; ASTM=American Society for Testing and Material; BAAQMD=Bay Area Air Quality Management District; BEES= Building for Environmental and Economic Sustainability; CA=California; Caltrans=California Department of Transportation; CAPs=Criteria Air Pollutants; CCAP=Center for Clean Air Policy; CF=Connectivity Factor; CIWMB=California Integrated Waste Management Board; CO= Carbon Monoxide; CO_2=Carbon Dioxide; DGS=Department of General Services; DOE=U.S. Department of Energy; DPF=Diesel particulate Filter; E85=85% Ethanol; EERE=Energy Efficiency and Renewable Energy; EOE=Encyclopedia of Earth; EPA=U.S. Environmental Protection Agency; ETC=Edmonton Trolley Coalition; EVs/CNG=Electric Vehicles/Compressed Natural Gas; FAR=Floor Area Ratio; GHG=Greenhouse Gas; ITE=Institute of Transportation Engineers; kg/m^2=kilogram per square meter; km=Kilometer; lb=pound; LEED=Leadership in Energy and Environmental Design; M=Million; NA=Not Available; NEV=Neighborhood Electric Vehicle; NIST=National Institute of Standards and Technology; NO_X=Oxides of Nitrogen; NREL=National Renewable Energy Laboratory; N/S=North/South; PG&E=Pacific Gas and Electric; PM=Particulate Matter; SJVAPCD=San Joaquin Valley Air Pollution Control District; SMAQMD=Sacramento Metropolitan Air Quality Management District; SMUD=Sacramento Municipal Utilities District; SO_x=Sulfur Oxides; SRI=Solar Reflectance Index; TACs=Toxic Air Contaminants; TDM=Transportation Demand Management; TMA=Transportation Management Association; THC=Total Hydrocarbon; ULEV=Ultra Low Emission Vehicle; USGBC=U.S. Green Building Council; and VTPI=Victoria Transit Policy.

State CEQA Guidelines – Section 15064, DETERMINING THE SIGNIFICANCE OF THE ENVIRONMENTAL EFFECTS CAUSED BY A PROJECT:

(a) Determining whether a project may have a significant effect plays a critical role in the CEQA process.

(1) If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, the agency shall prepare a draft EIR.

(2) When a final EIR identifies one or more significant effects, the Lead Agency and each Responsible Agency shall make a finding under Section 15091 for each significant effect and may need to make a statement of overriding considerations under Section 15093 for the project.

(b) The determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved, based to the extent possible on scientific and factual data. An ironclad definition of significant effect is not always possible because the significance of an activity may vary with the setting. For example, an activity which may not be significant in an urban area may be significant in a rural area.

(c) In determining whether an effect will be adverse or beneficial, the Lead Agency shall consider the views held by members of the public in all areas affected as expressed in the whole record before the lead agency. Before requiring the preparation of an EIR, the Lead Agency must still determine whether environmental change itself might be substantial.

(d) In evaluating the significance of the environmental effect of a project, the Lead Agency shall consider direct physical changes in the environment which may be caused by the project and reasonably foreseeable indirect physical changes in the environment which may be caused by the project.

(1) A direct physical change in the environment is a physical change in the environment which is caused by and immediately related to the project. Examples of direct physical changes in the environment are the dust, noise, and traffic of heavy equipment that would result from construction of a sewage treatment plant and possible odors from operation of the plant.

(2) An indirect physical change in the environment is a physical change in the environment which is not immediately related to the project, but which is caused indirectly by the project. If a direct physical change in the environment in turn causes another change in the environment, then the other change is an indirect physical change in the environment. For example, the construction of a new sewage treatment plant may facilitate population growth in the service area due to the increase in sewage treatment capacity and may lead to an increase in air pollution.

(3) An indirect physical change is to be considered only if that change is a reasonably foreseeable impact which may be caused by the project. A change which is speculative or unlikely to occur is not reasonably foreseeable.

(e) Economic and social changes resulting from a project shall not be treated as significant effects on the environment. Economic or social changes may be used, however, to determine that a physical change shall be regarded as a significant effect on the environment. Where a physical change is caused by economic or social effects of a

project, the physical change may be regarded as a significant effect in the same manner as any other physical change resulting from the project. Alternatively, economic and social effects of a physical change may be used to determine that the physical change is a significant effect on the environment. If the physical change causes adverse economic or social effects on people, those adverse effects may be used as a factor in determining whether the physical change is significant. For example, if a project would cause overcrowding of a public facility and the overcrowding causes an adverse effect on people, the overcrowding would be regarded as a significant effect.
(f) The decision as to whether a project may have one or more significant effects shall be based on substantial evidence in the record of the lead agency.
(1) If the lead agency determines there is substantial evidence in the record that the project may have a significant effect on the environment, the lead agency shall prepare an EIR (Friends of B Street v. City of Hayward (1980) 106 Cal.App.3d 988). Said another way, if a lead agency is presented with a fair argument that a project may have a significant effect on the environment, the lead agency shall prepare an EIR even though it may also be presented with other substantial evidence that the project will not have a significant effect (No Oil, Inc. v. City of Los Angeles (1974) 13 Cal.3d 68).
(2) If the lead agency determines there is substantial evidence in the record that the project may have a significant effect on the environment but the lead agency determines that revisions in the project plans or proposals made by, or agreed to by, the applicant would avoid the effects or mitigate the effects to a point where clearly no significant effect on the environment would occur and there is no substantial evidence in light of the whole record before the public agency that the project, as revised, may have a significant effect on the environment then a mitigated negative declaration shall be prepared.
(3) If the lead agency determines there is no substantial evidence that the project may have a significant effect on the environment, the lead agency shall prepare a negative declaration (Friends of B Street v. City of Hayward (1980) 106 Cal.App. 3d 988).
(4) The existence of public controversy over the environmental effects of a project will not require preparation of an EIR if there is no substantial evidence before the agency that the project may have a significant effect on the environment.
(5) Argument, speculation, unsubstantiated opinion or narrative, or evidence that is clearly inaccurate or erroneous, or evidence that is not credible, shall not constitute substantial evidence. Substantial evidence shall include facts, reasonable assumptions predicated upon facts, and expert opinion support by facts.
(6) Evidence of economic and social impacts that do not contribute to or are not caused by physical changes in the environment is not substantial evidence that the project may have a significant effect on the environment.
(7) The provisions of sections 15162, 15163, and 15164 apply when the project being analyzed is a change to, or further approval for, a project for which an EIR or negative declaration was previously certified or adopted (e.g. a tentative subdivision, conditional use permit). Under case law, the fair argument standard does not apply to determinations of significance pursuant to sections 15162, 15163, and 15164.
(g) After application of the principles set forth above in Section 15064(f)(g), and in marginal cases where it is not clear whether there is substantial evidence that a project may have a significant effect on the environment, the lead agency shall be guided by the following principle: If there is disagreement among expert opinion supported by facts

over the significance of an effect on the environment, the Lead Agency shall treat the effect as significant and shall prepare an EIR.
(h)(1) When assessing whether a cumulative effect requires an EIR, the lead agency shall consider whether the cumulative impact is significant and whether the effects of the project are cumulatively considerable. An EIR must be prepared if the cumulative impact may be significant and the project's incremental effect, though individually limited, is cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.
(2) A lead agency may determine in an initial study that a project's contribution to a significant cumulative impact will be rendered less than cumulatively considerable and thus is not significant. When a project might contribute to a significant cumulative impact, but the contribution will be rendered less than cumulatively considerable through mitigation measures set forth in a mitigated negative declaration, the initial study shall briefly indicate and explain how the contribution has been rendered less than cumulatively considerable.
(3) A lead agency may determine that a project's incremental contribution to a cumulative effect is not cumulatively considerable if the project will comply with the requirements in a previously approved plan or mitigation program which provides specific requirements that will avoid or substantially lessen the cumulative problem (e.g., water quality control plan, air quality plan, integrated waste management plan) within the geographic area in which the project is located. Such plans or programs must be specified in law or adopted by the public agency with jurisdiction over the affected resources through a public review process to implement, interpret, or make specific the law enforced or administered by the public agency. If there is substantial evidence that the possible effects of a particular project are still cumulatively considerable notwithstanding that the project complies with the specified plan or mitigation program addressing the cumulative problem, an EIR must be prepared for the project.
(4) The mere existence of significant cumulative impacts caused by other projects alone shall not constitute substantial evidence that the proposed project's incremental effects are cumulatively considerable.

State CEQA Guidelines – Section 15130, DISCUSSION OF CUMULATIVE IMPACTS:
(a)(3). "An EIR may determine that a project's contribution to a significant cumulative impact will be rendered less than cumulatively considerable and thus is not significant. A project's contribution is less than cumulatively considerable if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact. The lead agency shall identify facts and analysis supporting its conclusion that the contribution will be rendered less than cumulatively considerable.

State CEQA Guidelines – Section 15064.7, THRESHOLDS OF SIGNIFICANCE:
"Each public agency is encouraged to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects. A threshold of significance is an identifiable quantitative, qualitative or performance level

of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant."

Appendix B

Mitigation Measure Summary

Table 16
Mitigation Measure Summary

Mitigation Measure	Applicable Project/Source Type[1]	Effective	Feasible (Yes/No)			Secondary Effects (Yes/No)	Agency/Organization/Other[6]	Description/Comments
		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
Transportation								
Bicycle/Pedestrian/Transit Measures								
MM T-1: Bike Parking	LD (C, M), I, SP, TP, AQP, RR, P/Mobile	1%-5%/High: CCAP presents combined % reductions for a range of mitigation measures (Dierkers et al. 2007). SMAQMD allocates combined reductions among individual measures (e.g., 2.5% reduction for all bicycle-related measures and one-quarter of 2.5% for each individual measure) (TIAX 2005, EDAW 2006, SMAQMD 2007). VTPI presents % reductions for showers and combined measures in the TDM encyclopedia (VTPI	Yes: Lockers ($1,200-$2,950, $700/bike on average), Racks ($70-$2,000, $70/bike on average).	Yes (Caltrans 2005, Dierkers et al. 2007, VTPI 2007)	Yes (Caltrans 2005, Dierkers et al. 2007, VTPI 2007)	Adverse: No Beneficial: CAPs, TACs	Caltrans, Portland Bicycle Master Plan (City of Portland 1998), CCAP Transportation Emissions Guidebook (Dierkers et al. 2007), SMAQMD Recommended Guidance for Land Use Emission Reductions (SMAQMD 2007), VTPI, CA air quality management and control districts, and cities/counties.	Nonresidential projects provide plentiful short- and long-term bicycle parking facilities to meet peak season maximum demand (e.g., one bike rack space per 20 vehicle/employee parking spaces.
MM T-2: End of Trip Facilities	LD (C, M), I, SP, TP, AQP, RR, P/Mobile		Yes	Yes (Caltrans 2005, Dierkers et al. 2007, VTPI 2007)	Yes (Caltrans 2005, Dierkers et al. 2007, VTPI 2007)	Adverse: No Beneficial: CAPs, TACs		Nonresidential projects provide "end-of-trip" facilities including showers, lockers, and changing space (e.g., four clothes lockers and one shower provided for every 80 employee parking spaces, separate facilities for each gender for projects with 160 or more employee parking spaces).
MM T-3: Bike-Parking at Multi-	LD (R, M), SP, AQP, RR,		Yes: Lockers ($1,200-	Yes (Caltrans 2005,	Yes (Caltrans	Adverse: No Beneficial:		Long-term bicycle parking is provided at apartment

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Mitigation Measure	Applicable Project/Source Type[1]	Effective	Feasible (Yes/No)			Secondary Effects (Yes/No)	Agency/Organization/Other[6]	Description/Comments
		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
Unit Residential	P/Mobile	2007). JSA bases estimates on CCAP information (JSA 2004).	$2,950, $700/bike on average), Racks ($70-$2,000, $70/bike on average).	Dierkers et al. 2007, VTPI 2007)	2005, Dierkers et al. 2007, VTPI 2007)	CAPs, TACs		complexes or condominiums without garages (e.g., one long-term bicycle parking space for each unit without a garage). Long-term facilities shall consist of one of the following: a bicycle locker, a locked room with standard racks and access limited to bicyclists only, or a standard rack in a location that is staffed and/or monitored by video surveillance 24 hours per day.
MM T-4: Proximity to Bike Path/Bike Lanes	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile		Yes	Yes (Caltrans 2005, Dierkers et al. 2007, VTPI 2007)	Yes (Caltrans 2005, Dierkers et al. 2007, VTPI 2007)	Adverse: No Beneficial: CAPs, TACs		Entire project is located within one-half mile of an existing/planned Class I or Class II bike lane and project design includes a comparable network that connects the project uses to the existing offsite facility. Project design includes a designated bicycle route connecting all units, on-site bicycle parking facilities, offsite bicycle facilities, site entrances, and primary building entrances to existing Class I or Class II bike lane(s) within one-half mile. Bicycle route connects to all streets contiguous with project site. Bicycle route has minimum conflicts with automobile parking and circulation

Table 16
Mitigation Measure Summary

Mitigation Measure	Applicable Project/Source Type[1]	Effective	Feasible (Yes/No)			Secondary Effects (Yes/No)	Agency/Organization/Other[6]	Description/Comments
		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
								facilities. All streets internal to the project wider than 75 feet have Class II bicycle lanes on both sides.

AG=Attorney General; ARB=California Air Resources Board; ASTM=American Society for Testing and Material; BAAQMD=Bay Area Air Quality Management District; BEES= Building for Environmental and Economic Sustainability; CA=California; Caltrans=California Department of Transportation; CAPs=Criteria Air Pollutants; CCAP=Center for Clean Air Policy; CF=Connectivity Factor; CIWMB=California Integrated Waste Management Board; CO= Carbon Monoxide; CO_2=Carbon Dioxide; DGS=Department of General Services; DOE=U.S. Department of Energy; DPF=Diesel particulate Filter; E85=85% Ethanol; EERE=Energy Efficiency and Renewable Energy; EOE=Encyclopedia of Earth; EPA=U.S. Environmental Protection Agency; ETC=Edmonton Trolley Coalition; EVs/CNG=Electric Vehicles/Compressed Natural Gas; FAR=Floor Area Ratio; GHG=Greenhouse Gas; ITE=Institute of Transportation Engineers; kg/m^2=kilogram per square meter; km=Kilometer; lb=pound; LEED=Leadership in Energy and Environmental Design; M=Million; NA=Not Available; NEV=Neighborhood Electric Vehicle; NIST=National Institute of Standards and Technology; NO_X=Oxides of Nitrogen; NREL=National Renewable Energy Laboratory; N/S=North/South; PG&E=Pacific Gas and Electric; PM=Particulate Matter; SJVAPCD=San Joaquin Valley Air Pollution Control District; SMAQMD=Sacramento Metropolitan Air Quality Management District; SMUD=Sacramento Municipal Utilities District; SO_x=Sulfur Oxides; SRI=Solar Reflectance Index; TACs=Toxic Air Contaminants; TDM=Transportation Demand Management; TMA=Transportation Management Association; THC=Total Hydrocarbon; ULEV=Ultra Low Emission Vehicle; USGBC=U.S. Green Building Council; and VTPI=Victoria Transit Policy.

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Mitigation Measure	Applicable Project/Source Type[1]	Effective	Feasible (Yes/No)			Secondary Effects (Yes/No)	Agency/Organization/Other[6]	Description/Comments
		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
MM T-5: Pedestrian Network	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	1%-10%/High: CCAP presents combined % reductions for a range of mitigation measures (Dierkers et al. 2007). SMAQMD allocates 1% for each individual measure (TIAX 2005, EDAW 2006, SMAQMD 2007).	Yes	Yes (Dierkers et al. 2007, VTPI 2007)	Yes (Dierkers et al. 2007, VTPI 2007)	Adverse: No Beneficial: CAPs, TACs	CCAP Transportation Emissions Guidebook (Dierkers et al. 2007), SMAQMD Recommended Guidance for Land Use Emission Reductions (SMAQMD 2007), VTPI, CA air quality management and control districts, and cities/counties.	The project provides a pedestrian access network that internally links all uses and connects to all existing/planned external streets and pedestrian facilities contiguous with the project site. Project design includes a designated pedestrian route interconnecting all internal uses, site entrances, primary building entrances, public facilities, and adjacent uses to existing external pedestrian facilities and streets. Route has minimal conflict with parking and automobile circulation facilities. Streets (with the exception of alleys) within the project have sidewalks on both sides. All sidewalks internal and adjacent to project site are minimum of five feet wide. All sidewalks feature vertical curbs. Pedestrian facilities and improvements such as grade separation, wider sidewalks, and traffic calming are implemented wherever feasible to minimize pedestrian barriers. All site entrances provide pedestrian access.
MM T-6: Pedestrian	LD (R, C, M), I, SP, TP,		Yes	Yes (Dierkers et al. 2007,	Yes (Dierkers et	Adverse: No Beneficial:		Site design and building placement minimize barriers to

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Mitigation Measure	Applicable Project/Source Type[1]	Effective		Feasible (Yes/No)		Secondary Effects (Yes/No)	Agency/Organization/Other[6]	Description/Comments
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Barriers Minimized	AQP, RR, P/Mobile			VTPI 2007)	al. 2007, VTPI 2007)	CAPs, TACs		pedestrian access and interconnectivity. Physical barriers such as walls, berms, landscaping, and slopes between residential and nonresidential uses that impede bicycle or pedestrian circulation are eliminated.
MM T-7: Bus Shelter for Existing/Planned Transit Service	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	1%-2%/High: CCAP presents these % reductions (Dierkers et al., 2007). SMAQMD assigns from .25%-1%, depending on headway frequency (TIAX 2005, EDAW 2006, SMAQMD 2007).	Yes: $15,000-$70,000.	Yes (Dierkers et al. 2007, VTPI 2007)	Yes (Dierkers et al. 2007, VTPI 2007)	Adverse: No Beneficial: CAPs, TACs	CCAP Transportation Emissions Guidebook (Dierkers et al. 2007), SMAQMD Recommended Guidance for Land Use Emission Reductions (SMAQMD 2007), VTPI, City of Calgary (City of Calgary 2004), CA air quality management and control districts, and cities/counties.	Bus or streetcar service provides headways of one hour or less for stops within one-quarter mile; project provides safe and convenient bicycle/pedestrian access to transit stop(s) and provides essential transit stop improvements (i.e., shelters, route information, benches, and lighting).

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Mitigation Measure	Applicable Project/Source Type[1]	Effective	Feasible (Yes/No)			Secondary Effects (Yes/No)	Agency/Organization/Other[6]	Description/Comments
		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
MM T-8: Traffic Calming	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	1%-10%/High: CCAP presents combined % reductions for a range of mitigation measures (Dierkers et al. 2007). SMAQMD allocates .25%-1.0% for each individual measure depending on percent of intersections and streets with improvements (TIAX 2005, EDAW 2006, SMAQMD 2007).	Yes	Yes (Dierkers et al. 2007, VTPI 2007)	Yes (Dierkers et al. 2007, VTPI 2007)	Adverse: No Beneficial: CAPs, TACs	CCAP Transportation Emissions Guidebook (Dierkers et al. 2007), SMAQMD Recommended Guidance for Land Use Emission Reductions (SMAQMD 2007), VTPI, CA air quality management and control districts, and cities/counties.	Project design includes pedestrian/bicycle safety and traffic calming measures in excess of jurisdiction requirements. Roadways are designed to reduce motor vehicle speeds and encourage pedestrian and bicycle trips by featuring traffic calming features. All sidewalks internal and adjacent to project site are minimum of five feet wide. All sidewalks feature vertical curbs. Roadways that converge internally within the project are routed in such a way as to avoid "skewed intersections;" which are intersections that meet at acute, rather than right, angles. Intersections internal and adjacent to the project feature one or more of the following pedestrian safety/traffic calming design techniques: marked crosswalks, count-down signal timers, curb extensions, speed tables, raised crosswalks, raised intersections, median islands, tight corner radii, and roundabouts or mini-circles. Streets internal and adjacent to the project feature pedestrian safety/traffic calming measures such as on-street parking, planter strips with street trees,

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								and chicanes/chokers (variations in road width to discourage high-speed travel).
Parking Measures								
MM T-9: Paid Parking (Parking Cash Out)	LD (C, M), I, SP, TP, AQP, RR, P/Mobile	1%-30%/High: CCAP presents a range of 15%-30% reduction for parking programs (Dierkers et al. 2007). SMAQMD presents a range of 1.0%-7.2%, depending on cost/day and distance to transit (TIAX 2005, EDAW 2006, SMAQMD 2007). Shoupe presents a 21% reduction [$5/day for commuters to downtown LA, with elasticity of -0.18 (e.g., if price increases 10%, then solo driving goes down by 1.8% more)] (Shoupe 2005). Urban Transit Institute	Yes: Vary by location and project size.	Yes (Dierkers et al. 2007, VTPI 2007)	Yes (Dierkers et al. 2007, VTPI 2007)	Adverse: No Beneficial: CAPs, TACs	CCAP Transportation Emissions Guidebook (Dierkers et al. 2007), SMAQMD Recommended Guidance for Land Use Emission Reductions (SMAQMD 2007), VTPI, CA air quality management and control districts, and cities/counties.	Project provides employee and/or customer paid parking system. Project must have a permanent and enforceable method of maintaining user fees for all parking facilities. The facility may not provide customer or employee validations. Daily charge for parking must be equal to or greater than the cost of a transit day/monthly pass plus 20%.

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
		presents a range of 1%-10% reduction in trips to central city sites, and 2%-4% in suburban sites (VTPI 2007).						
MM T-10: Minimum Parking	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	1%-30%/High: CCAP presents a range of 15%-30% reduction for parking programs (Dierkers et al. 2007). SMAQMD presents a maximum of 6% (Nelson/Nygaard Consulting Associates, 2005, TIAX 2005, EDAW 2006).	Yes	Yes (Dierkers et al. 2007, VTPI 2007)	Yes (Dierkers et al. 2007, VTPI 2007), Note that in certain areas of the state, the minimum parking required by code is greater than the peak period parking demand for most land uses. Simply meeting minimum code requirements in these areas would not result in an emissions reduction.	Adverse: No Beneficial: CAPs, TACs	CCAP Transportation Emissions Guidebook (Dierkers et al. 2007), SMAQMD Recommended Guidance for Land Use Emission Reductions (SMAQMD 2007), VTPI, Governor's Office of Smart Growth (Annapolis, Maryland) (Zimbler), CA air quality management and control districts, and cities/counties.	Provide minimum amount of parking required. Once land uses are determined, the trip reduction factor associated with this measure can be determined by utilizing the ITE parking generation publication. The reduction in trips can be computed as shown below by the ratio of the difference of minimum parking required by code and ITE peak parking demand to ITE peak parking demand for the land uses multiplied by 50%. Percent Trip Reduction = 50 * [(min parking required by code – ITE peak parking demand)/ (ITE peak parking demand)]

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
MM T-11: Parking Reduction Beyond Code/Shared Parking	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	1%-30%/High: CCAP presents a range of 15%-30% reduction for parking programs (Dierkers et al. 2007). SMAQMD presents a maximum of 12% (Nelson/Nygaard, 2005, TIAX 2005, EDAW 2006).	Yes	Yes (Dierkers et al. 2007, VTPI 2007)	Yes (Dierkers et al. 2007, VTPI 2007)	Adverse: No Beneficial: CAPs, TACs		Provide parking reduction less than code. This measure can be readily implemented through a shared parking strategy, wherein parking is utilized jointly among different land uses, buildings, and facilities in an area that experience peak parking needs at different times of day and day of the week.
MM T-12: Pedestrian Pathway Through Parking	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	1%-4%/Moderate: CCAP presents combined % reductions for a range of mitigation measures (Dierkers et al. 2007). SMAQMD allocates 0.5% reduction for this measure (TIAX 2005, EDAW 2006, SMAQMD 2007).	Yes	Yes (Dierkers et al. 2007, VTPI 2007)	Yes (Dierkers et al. 2007, VTPI 2007)	Adverse: No Beneficial: CAPs, TACs		Provide a parking lot design that includes clearly marked and shaded pedestrian pathways between transit facilities and building entrances.

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
MM T-13: Off - Street Parking	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	1%-4%/Moderate: CCAP presents combined % reductions for a range of mitigation measures (Dierkers et al. 2007). SMAQMD allocates a range of 0.1%-1.5% for this measure (TIAX 2005, EDAW 2006, SMAQMD 2007).	Yes	Yes (Dierkers et al. 2007, VTPI 2007)	Yes (Dierkers et al. 2007, VTPI 2007)	Adverse: No Beneficial: CAPs, TACs		Parking facilities are not adjacent to street frontage.
MM T-14: Parking Area Tree Cover	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	Annual net CO_2 reduction of 3.1 kg/m^2 canopy cover/Moderate (McPherson 2001).	Yes: $19 per new tree for CA, cost varies for maintenance, removal and replacement (McPherson 2001).	Yes	Yes	Adverse: VOCs Beneficial: CAPs, TACs	AG, State of CA Department of Justice (Goldberg 2007) and cities/counties (e.g., parking lot ordinances in Sacramento, Davis, and Los Angeles, CA).	Provide parking lot areas with 50% tree cover within 10 years of construction, in particular low emitting, low maintenance, native drought resistant trees. Reduces urban heat island effect and requirement for air conditioning, effective when combined with other measures (e.g., electrical maintenance equipment and reflective paving material).
MM T-15: Valet Bicycle Parking	LD (C, M), SP, AQP, TP, RR, P/Mobile	NA/Low	Yes	Yes	Yes: Raley Field (Sacramento, CA)	Adverse: No Beneficial: CAPs, TACs	Raley Field (Sacramento, CA).	Provide spaces for the operation of valet bicycle parking at community event "centers" such as amphitheaters, theaters, and stadiums.
MM T-16: Garage Bicycle Storage	LD (R, M), SP, AQP, TP, RR, P/Mobile	NA/Low	Yes: Less than $200/multiple bike rack.	Yes	Yes	Adverse: No Beneficial: CAPs, TACs	City of Fairview, OR	Provide storage space in one-car garages for bicycles and bicycle trailers.

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
MM T-17: Preferential Parking for EVs/CNG Vehicles	LD (C, M), I, SP, TP, AQP, RR, P/Mobile	NA/Low	Yes	Yes	Yes	Adverse: No Beneficial: CAPs, TACs	USGBC, CA air quality management and control districts and cities/counties (e.g., BAAQMD).	Provide preferential parking space locations for EVs/CNG vehicles.
MM T-18: Reduced/No Parking Fee for EVs/CNG Vehicles	LD (C, M), I, SP, TP, AQP, RR, P/Mobile	NA/Low	Yes	Yes	Yes	Adverse: No Beneficial: CAPs, TACs	Hotels (e.g., Argonaut in San Francisco, CA)	Provide a reduced/no parking fee for EVs/CNG vehicles.

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
Miscellaneous Measure								
MM T-19: TMA Membership	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	1%-28%/High: CCAP presents a range of 3%-25% for TDMs with complementary transit and land use measures (Dierkers et al. 2007). VTPI presents a range of 6%-7% in the TDM encyclopedia (VTPI 2007). URBEMIS offers a 2%-10% range in reductions for a TDM that has 5 elements that are pedestrian and transit friendly and 1%-5% for 3 elements. SMAQMD presents a reduction of 5% (TIAX 2005, EDAW 2006, SMAQMD 2007).	Yes	Yes (Dierkers et al. 2007, VTPI 2007)	Yes (Dierkers et al. 2007, VTPI 2007)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Include permanent TMA membership and funding requirement. Funding to be provided by Community Facilities District or County Service Area or other nonrevocable funding mechanism. TDMs have been shown to reduce employee vehicle trips up to 28% with the largest reductions achieved through parking pricing and transit passes. The impact depends on the travel alternatives.
MM T-20: ULEV	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	NA/Low	Yes: Higher than corresponding gasoline models.	Yes	Yes: Fueling stations might not be readily available depending on location. More than 900 E85 fueling	Adverse: No Beneficial: CAPs, TACs	DGS, CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Use of and/or provide ULEV that are 50% cleaner than average new model cars (e.g., natural gas, ethanol, electric).

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
					stations in the U.S., 5 in CA. Vehicles available in select regions only			
MM T-21: Flex Fuel Vehicles	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	5466.97 lb GHG/year/Low (DOE Fuel Economy)	Yes: E85 costs less than gasoline per gallon, but results in lower fuel economy.	Yes	Yes: More than 900 E85 fueling stations in the U.S., 5 in CA. Vehicles available in select regions only	Adverse: Yes Issues with the energy intensive ethanol production process (e.g., wastewater treatment requirements). Beneficial: CAPs, TACs	DGS, CA air quality management and control districts and cities/counties (e.g., SJVAPCD).	Use of and/or provide vehicles that utilize gasoline/ethanol blends (e.g., E85).
Design								
Commercial & Residential Building Design Measures								
MM D-1: Office/Mixed Use Density	LD (C, M), SP, TP, AQP, RR, P/Mobile	0.05%-2%/Moderate: This range is from SMAQMD, depending	Yes	Yes (VTPI 2007)	Yes (VTPI 2007)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties	Project provides high density office or mixed-use proximate to transit. Project must provide

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		on FAR and headway frequencies (Nelson/Nygaard Consulting Associates 2005, EDAW 2006, SMAQMD 2007).					(e.g., SMAQMD).	safe and convenient pedestrian and bicycle access to all transit stops within one-quarter mile.
MM D-2: Orientation to Existing/Planned Transit, Bikeway, or Pedestrian Corridor	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	0.4%-1%/Moderate: CCAP attributes a 0.5% reduction per 1% improvement in transit frequency (Dierkers et al. 2007). SMAQMD presents a range of 0.25%-5% (JSA 2005, EDAW 2006, SMAQMD 2007).	Yes	Yes (Dierkers et al. 2007)	Yes (Dierkers et al. 2007)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Project is oriented towards existing transit, bicycle, or pedestrian corridor. Setback distance between project and existing or planned adjacent uses is minimized or nonexistent. Setback distance between different buildings on project site is minimized. Setbacks between project buildings and planned or existing sidewalks are minimized. Buildings are oriented towards existing or planned street frontage. Primary entrances to buildings are located along planned or existing public street frontage. Project provides bicycle access to any planned bicycle corridor(s). Project provides pedestrian access to any planned pedestrian corridor(s).
MM D-3: Services Operational	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	0.5%-5%/Moderate	Yes	Yes	Yes	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Project provides on-site shops and services for employees.

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MM D-4: Residential Density (Employ Sufficient Density for New Residential Development to Support the Use of Public Transit)	LD (R, M), SP, TP, AQP, RR, P/Mobile	1%-40%/High: #7, EPA presents a range of 32%-40% (EPA 2006). SMAQMD presents a range of 1%-12% depending on density and headway frequencies (Nelson/Nygaard Consulting Associates 2005, JSA 2005, EDAW 2006, SMAQMD 2007). Nelson/Nygaard presents a trip reduction formula: Trip Reduction = 0.6*(1-(19749*((4.814+ households per residential acre)/(4.814+7.14))^-06.39)/25914).	Yes	Yes (VTPI 2007, Holtzclaw 2007)	Yes (VTPI 2007, Holtzclaw 2007)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Project provides high-density residential development. Transit facilities must be within one-quarter mile of project border. Project provides safe and convenient bicycle/pedestrian access to all transit stop(s) within one-quarter mile of project border.
MM D-5: Street Grid	LD (R, C, M), I, SP, TP, AQP, RR,	1%/Moderate: SMAQMD presents this % reduction (JSA	Yes	Yes (Dierkers et al. 2007, VTPI 2007)	Yes (Dierkers et al. 2007,	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties	Multiple and direct street routing (grid style). This measure only applies to projects

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
	P/Mobile	2005, EDAW 2006, SMAQMD 2007).			VTPI 2007)		(e.g., SMAQMD).	with an internal CF >/= 0.80, and average of one-quarter mile or less between external connections along perimeter of project. [CF= # of intersections / (# of cul-de-sacs + intersections)]. Cul-de-sacs with bicycle/pedestrian through access may be considered "complete intersections" when calculating the project's internal connectivity factor. External connections are bike/pedestrian pathways and access points, or streets with safe and convenient bicycle and pedestrian access that connect the project to adjacent streets, sidewalks, and uses. If project site is adjacent to undeveloped land; streets, pathways, access points, and right-of-ways that provide for future access to adjacent uses may count for up to 50% of the external connections. Block perimeter (the sum of the measurement of the length of all block sides) is limited to no more than 1,350 feet. Streets internal to the project should connect to streets external to the project whenever possible.

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MM D-6: NEV Access	LD (R, C, M), SP, TP, AQP, RR, P/Mobile	0.5%-1.5%/Low: SMAQMD presents this % reduction (EDAW 2006, SMAQMD 2007).	Yes	Yes (Litman 1999, Sperling 1994)	Yes (Litman 1999, Sperling 1994)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Make physical development consistent with requirements for neighborhood electric vehicles. Current studies show that for most trips, NEVs do not replace gas-fueled vehicles as the primary vehicle.
MM D-7: Affordable Housing Component	LD (R, M), SP, TP, AQP, RR, P/Mobile	0.4%-6%/Moderate: SMAQMD presents this % reduction (Nelson/Nygaard Consulting Associates 2005, EDAW 2006, SMAQMD 2007).	Yes	Yes	Yes	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Residential development projects of five or more dwelling units provide a deed-restricted low-income housing component on-site (or as defined in the code). Developers who pay into In-Lieu Fee Programs are not considered eligible to receive credit for this measure. The award of emission reduction credit shall be based only on the proportion of affordable housing developed on-site because in-lieu programs simply induce a net increase in development. Percentage reduction shall be calculated according to the following formula:

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
								% reduction = % units deed-restricted below market rate housing * 0.04
MM D-8: Recharging Area	LD (R, M), SP, TP, AQP, RR, P/Mobile	NA/Low	Yes	Yes	Yes	Adverse: No Beneficial: CAPs, TACs		Provide residential buildings with a "utility" room or space for recharging batteries, whether for use in a car, electric lawnmower, other electric landscaping equipment, or even batteries for small items such as flashlights.
Mixed-Use Development Measures								
MM D-9: Urban Mixed-Use	LD (M), SP, TP, AQP, RR, P/Mobile	3%-9%/Moderate: SMAQMD presents this % reduction (TIAX 2005, EDAW 2006, SMAQMD 2007).	Yes	Yes (EPA 2006)	Yes (EPA 2006)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Development of projects predominantly characterized by properties on which various uses, such as office, commercial, institutional, and residential, are combined in a single building or on a single site in an integrated development project with functional interrelationships and a coherent physical design.
MM D-10: Suburban Mixed-Use	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	3%/Moderate: SMAQMD presents this % reduction (TIAX 2005, EDAW 2006, SMAQMD 2007).	Yes	Yes (EPA 2006)	Yes (EPA 2006)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Have at least three of the following on site and/or offsite within one-quarter mile: Residential Development, Retail Development, Park, Open Space, or Office.
MM D-11: Other Mixed-Use	LD (R, M), SP, TP, AQP, RR, P/Mobile	1%/Moderate: SMAQMD presents this % reduction (TIAX 2005, EDAW	Yes	Yes (EPA 2006)	Yes (EPA 2006)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	All residential units are within one-quarter mile of parks, schools or other civic uses.

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		2006, SMAQMD 2007).						
MM D-12: Infill Development	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	3%-30%/High: Infill development reduces vehicle trips and VMT by 3% and 20%, respectively (Fehr & Peers 2007). CCAP identifies a site level VMT reduction range of 20%-30% (Dierkers et al. 2007).	Yes	Yes (Dierkers et al. 2007)	Yes (Dierkers et al. 2007)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Project site is on a vacant infill site, redevelopment area, or brownfield or greyfield lot that is highly accessible to regional destinations, where the destinations rating of the development site (measured as the weighted average travel time to all other regional destinations) is improved by 100% when compared to an alternate greenfield site.
Miscellaneous Measures								
MM D-13: Electric Lawnmower	LD (R, M), SP, AQP, RR, P/Area	1%/Low: SMAQMD presents this % reduction (EDAW 2006, SMAQMD 2007).	Yes	Yes	Yes	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Provide a complimentary electric lawnmower to each residential buyer.

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
MM D-14: Enhanced Recycling/Waste Reduction, Reuse, Composting	LD (R, C, M), I, SP, AQP, RR, P/Stationary & Area	NA/Low	Yes	Yes	Yes: Association with social awareness.	Adverse: No Beneficial: CAPs, TACs	CIWMB	Provide infrastructure/education that promotes the avoidance of products with excessive packaging, recycle, buying of refills, separating of food and yard waste for composting, and using rechargeable batteries.
MM D-15: LEED Certification	LD (R, C, M), I, SP, AQP, RR, P/Stationary & Area	NA/Moderate	Yes: Receive tax rebates, incentives (e.g., EDAW San Diego office interior remodel cost $1,700,000 for 32,500 square feet) (USGBC 2007)	Yes	Yes: More than 700 buildings of different certifications in CA (USGBC 2007).	Adverse: No Beneficial: CAPs, TACs	USGBC, CA air quality management and control districts and cities/counties (e.g., BAAQMD).	LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.
MM D-16: Retro-Commissioning	LD (C, M), I, SP, AQP, RR, P/Stationary & Area	8%-10% reduction in energy usage/Moderate: (Mills et al. 2004)	Yes: Average $0.28/square feet, varies with building size (Haasl and Sharp 1999).	Yes	Yes: 27 projects underway in CA, 21 more to be completed in 2007, mostly state buildings owned by DGS (DGS 2007).	Adverse: No Beneficial: CAPs, TACs	DGS, CA air quality management and control districts and cities/counties (e.g., BAAQMD).	The process ensures that all building systems perform interactively according to the contract documents, the design intent and the owner's operational needs to optimize energy performance.
MM D-17 Landscaping	LD (R, C, M), I, SP, AQP, RR,	NA/Low	Yes	Yes	Yes	Adverse: No Beneficial: CAPs, TACs	Alliance for the Chesapeake Bay, EPA Green Landscaping	Project shall use drought resistant native trees, trees with low emissions and high carbon

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	P/Stationary & Area						Resources	sequestration potential. Evergreen trees on the north and west sides afford the best protection from the setting summer sun and cold winter winds. Additional considerations include the use of deciduous trees on the south side of the house that will admit summer sun; evergreen plantings on the north side will slow cold winter winds; constructing a natural planted channel to funnel summer cooling breezes into the house. Neighborhood CCR's not requiring that front and side yards of single family homes be planted with turf grass. Vegetable gardens, bunch grass, and low-water landscaping shall also be permitted, or even encouraged.
MM D-18: Local Farmers' Market	LD (M), SP/Mobile, Stationary, &	NA/Low	Yes	Yes	Yes: Associated with social	Adverse: No Beneficial: CAPs, TACs	Cities/counties (e.g., Davis, Sacramento)	Project shall dedicate space in a centralized, accessible location for a weekly farmers' market.

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	Area				choice and public awareness.			
MM D-19: Community Gardens	LD (M), SP/Mobile, Stationary, & Area	NA/Low	Yes	Yes	Yes: Associated with social choice and public awareness.	Adverse: No Beneficial: CAPs, TACs	Cities/counties (e.g., Davis)	Project shall dedicate space for community gardens.
Energy Efficiency/Building Component								
MM E-1: High-Efficiency Pumps	LD (R, C, M), SP, AQP, RR, P/Stationary & Area	NA/Low	Yes	Yes	Yes	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., BAAQMD).	Project shall use high-efficiency pumps.
MM E-2: Wood Burning Fireplaces/Stoves	LD (R, M), SP, AQP, RR, P/Stationary & Area	NA/Low: EDAW 2006	Yes	Yes	Yes	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Project does not feature fireplaces or wood burning stoves.
MM E-3: Natural Gas Stove	LD (R, M), SP, AQP, RR, P/Stationary & Area	NA/Low: EDAW 2006	Yes: Cost of stove—$350 (gas) and $360 (electric) same brand, total yearly cost of $42.17 as opposed to $56.65 for electric (Saving Electricity 2006).	Yes	Yes	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Project features only natural gas or electric stoves in residences.

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MM E-4: Energy Star Roof	LD (R, C, M), I, SP, AQP, RR, P/Stationary & Area	0.5%-1%/Low: SMAQMD presents this % reduction (EDAW 2006, SMAQMD 2007).	Yes	Yes	Yes: 866 Energy Star labeled buildings in California (Energy Star 2007)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Project installs Energy Star labeled roof materials.
MM E-5: On-site Renewable Energy System	LD (R, C, M), I, SP, AQP, RR, P/Stationary & Area	1%-3%/Moderate: SMAQMD presents this % reduction (USGBC 2002 and 2005, EDAW 2006, SMAQMD 2007).	Yes	Yes (USGBC 2002 and 2005)	Yes (USGBC 2002 and 2005)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Project provides onsite renewable energy system(s). Nonpolluting and renewable energy potential includes solar, wind, geothermal, low-impact hydro, biomass and bio-gas strategies. When applying these strategies, projects may take advantage of net metering with the local utility.

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MM E-6: Exceed Title 24	LD (R, C, M), I, GSP, AQP, RR, P/Stationary & Area	1%/Moderate: SMAQMD presents this % reduction (EDAW 2006, SMAQMD 2007).	Yes	Yes (PG&E 2002, SMUD 2006)	Yes (PG&E 2002, SMUD 2006)	Adverse: No Beneficial: CAPs, TACs	PG&E, SMUD, CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Project exceeds title 24 requirements by 20%.
MM E-7: Solar Orientation	LD (R, C, M), I, SP, AQP, RR, P/Stationary & Area	0.5%/Low: SMAQMD presents this % reduction (EDAW 2006, SMAQMD 2007).	Yes	Yes	Yes	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Project orients 75% or more of homes and/or buildings to face either north or south (within 30° of N/S). Building design includes roof overhangs that are sufficient to block the high summer sun, but not the lower winter sun, from penetrating south facing windows. Trees, other landscaping features and other buildings are sited in such a way as to maximize shade in the summer and maximize solar access to walls and windows in the winter.
MM E-8: Nonroof Surfaces	LD (R, C, M), I, GSP, AQP, RR, P/Stationary & Area	1.0%/Low: SMAQMD presents this % reduction (EDAW 2006, SMAQMD 2007).	Yes	Yes (USGBC 2002 and 2005)	Yes (USGBC 2002 and 2005)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Provide shade (within 5 years) and/or use light-colored/high-albedo materials (reflectance of at least 0.3) and/or open grid pavement for at least 30% of the site's nonroof impervious surfaces, including parking lots, walkways, plazas, etc.; OR place a minimum of 50% of parking spaces underground or covered by structured parking; OR use an open-grid pavement system (less than 50% impervious) for a minimum of

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								50% of the parking lot area. The mitigation measure reduces heat islands (thermal gradient differences between developed and undeveloped areas to minimize impact on microclimate and human and wildlife habitats. This measure requires the use of patented or copyright protected methodologies created by the ASTM. The SRI is a measure of the constructed surface's ability to reflect solar heat, as shown by a small rise in temperature. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is "0" and a standard white (reflectance 0.80, emittance 0.90) is 100. To calculate SRI for a given material, obtain the reflectance value and emittance value for the material. SRI is calculated according to ASTM E 1980-01. Reflectance is measured

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
								according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance is measured according to ASTM E 408 or ASTM C 1371. Default values for some materials will be available in the LEED-NC v2.2 Reference Guide.
MM E-9: Low-Energy Cooling	LD (C, M), I, SP, AQP, RR, P/Stationary & Area	1%-10%/Low: EDAW presents this percent reduction range (EDAW 2006).	Yes	Yes (USGBC 2002 and 2005)	Yes (USGBC 2002 and 2005)	Adverse: No Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Project optimizes building's thermal distribution by separating ventilation and thermal conditioning systems.
MM E-10: Green Roof	LD (R, C, M), I, SP, AQP, RR, P/Stationary & Area	1.0%/Moderate: SMAQMD presents this % reduction (EDAW 2006, SMAQMD 2007).	Yes	Yes (USGBC 2002 and 2005)	Yes (USGBC 2002 and 2005)	Adverse: Increased Water Consumption Beneficial: CAPs, TACs	CA air quality management and control districts and cities/counties (e.g., SMAQMD).	Install a vegetated roof that covers at least 50% of roof area. The reduction assumes that a vegetated roof is installed on a least 50% of the roof area or that a combination high albedo and vegetated roof surface is installed that meets the following standard: (Area of SRI Roof/0.75)+(Area of vegetated roof/0.5) >= Total Roof Area. Water consumption reduction measures shall be considered in the design of the green roof.
MM E-11: EV Charging Facilities	LD (C, M), SP, AQP, RR, P/Stationary & Area	NA/Low	Yes: $500-$5000/ vehicle site (PG&E 1999)	Yes	Yes: 381 facilities in CA (Clean Air Maps 2007).	Adverse: No Beneficial: CAPs, TACs	DOE, EERE, CA air quality management and control districts and cities/counties (e.g., BAAQMD).	Project installs EV charging facilities.
MM E-12:	LD (R, C, M),	NA/Low: Increasing	Yes: Light	Yes	Yes: Apply	Adverse: No		Project provides light-colored

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
Light-Colored Paving	I, SP, AQP, RR, P/Stationary & Area	the albedo of 1,250 km of pavement by 0.25 would save cooling energy worth $15M per year.	colored aggregates and white cement are more expensive than gray cement. Certain blended cements are very light in color and may reflect similarly to white cement at an equivalent cost to normal gray cement.		natural sand or gravel colored single surface treatments to asphalt (EOE 2007).	Beneficial: CAPs, TACs		paving (e.g., increased albedo pavement).
MM E-13: Cool Roofs	LD (R, C, M), I, SP, AQP, RR, P/Stationary & Area	NA/Low	Yes: 0.75–1.5/square feet coating (EPA 2007a)	Yes	Yes: Over 90% of the roofs in the United States are dark colored	Adverse: No Beneficial: CAPs, TACs	CEC	Project provides cool roofs. Highly reflective, highly emissive roofing materials that stay 50-60°F cooler than a normal roof under a hot summer sun. CA's Cool Savings

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					(EPA 2007a).			Program provided rebates to building owners for installing roofing materials with high solar reflectance and thermal emittance. The highest rebate went to roofs on air conditioned buildings, while buildings with rooftop ducts and other nonresidential buildings were eligible for slightly less. The program aimed to reduce peak summer electricity demand and was administered by the CEC.
MM E-14: Solar Water Heaters	LD (R, M), SP, AQP, RR, P/Stationary & Area	20%–70% reduction in cooling energy needs/Moderate	Yes: $1675/20 square feet, requires a 50 gallon tank, annual operating cost of $176 (DOE 2007).	Yes	Yes: Based on solar orientation, building codes, zoning ordinances.	Adverse: No Beneficial: CAPs, TACs	Europe	Project provides solar water heaters.
MM E-15: Electric Yard Equipment Compatibility	LD (R, M), SP, AQP, RR, P/Stationary & Area	NA/Low	Yes: $75–$250/outlet from existing circuit (Cost Helper 2007).	Yes	Yes	Adverse: No Beneficial: CAPs, TACs		Project provides electrical outlets at building exterior areas.
MM E-16: Energy Efficient Appliance Standards	LD (R, C, M), SP, AQP, RR, P/Stationary & Area	NA/Low	Yes: Varies for each appliance—higher capital costs, lower operating costs (Energy	Yes	Yes: Major retail stores.	Adverse: No Beneficial: CAPs, TACs		Project uses energy efficient appliances (e.g., Energy Star).

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
			Star 2007).					
MM E-17: Green Building Materials	LD (R, C, M), SP, AQP, RR, P/Stationary & Area	NA/Low: 25-30% more efficient on average.	Yes	Yes: BEES software allows users to balance the environmental and economic performance of building products; developed by NIST (NIST 2007).	Yes	Adverse: No Beneficial: CAPs, TACs		Project uses materials which are resource efficient, recycled, with long life cycles and manufactured in an environmentally friendly way.
MM E-18: Shading Mechanisms	LD (R, C, M), I, SP, AQP, RR, P/Stationary, & Area	NA/Low: Up to $450 annual energy savings (Energy Star 2007).	Yes: Higher capital costs, lower operating and maintenance costs (Energy Star 2007).	Yes	Yes: Major retail stores.	Adverse: No Beneficial: CAPs, TACs		Install energy-reducing shading mechanisms for windows, porch, patio and walkway overhangs.

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		Emissions Reduction/Score[2]	Cost (Yes/No)[3]	Technical[4]	Logistical[5]			
MM E-19: Ceiling/Whole-House Fans	LD (R, C, M), I, SP, AQP, RR, P/Stationary, & Area	NA/Low: 50% more efficient than conventional fans (Energy Star 2007).	Yes: $45-$200/fan, installation extra (Lowe's 2007).	Yes	Yes: Major retail stores.	Adverse: No Beneficial: CAPs, TACs		Install energy-reducing ceiling/whole-house fans.
MM E-20: Programmable Thermostats	LD (R, C, M), I, SP, AQP, RR, P/Stationary, & Area	NA/Low: $100 annual savings in energy costs (Energy Star 2007).	Yes: $60/LCD display and 4 settings for typical residential use (Lowe's 2007).	Yes	Yes: Major retail stores.	Adverse: Yes, Mercury Beneficial: CAPs, TACs		Install energy-reducing programmable thermostats that automatically adjust temperature settings.
MM E-21: Passive Heating and Cooling Systems	LD (R, C, M), I, SP, AQP, RR, P/Stationary, & Area	NA/Low	Yes: $800 (wall heaters) to $4,000+ (central systems)	Yes	Yes	Adverse: No Beneficial: CAPs, TACs		Install energy-reducing passive heating and cooling systems (e.g., insulation and ventilation).
MM E-22: Day Lighting Systems	LD (R, C, M), I, SP, AQP, RR, P/Stationary, & Area	NA/Low	Yes: $1,300 to $1,500 depending upon the kind of roof (Barrier 1995), installation extra.	Yes	Yes: Work well only for space near the roof of the building, little benefit in multi-floor buildings.	Adverse: No Beneficial: CAPs, TACs		Install energy-reducing day lighting systems (e.g., skylights, light shelves and interior transom windows).
MM E-23: Low-Water Use Appliances	LD (R, C, M), I, SP, AQP, RR, P/Stationary, & Area	NA/Low: Avoided water agency cost for using water-efficient kitchen pre-rinse spray valves of $65.18 per acre-foot.	Yes: Can return their cost through reduction in water consumption,	Yes	Yes	Adverse: No Beneficial: CAPs, TACs		Require the installation of low-water use appliances.

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			pumping, and treatment.					
MM E-24: Goods Transport by Rail	LD (C, M), I, SP, AQP, RR, P/Mobile	NA/Moderate	Yes	Yes	Yes	Adverse: No Beneficial: CAPs, TACs	ARB Goods Movement Plan (ARB 2007)	Provide a spur at nonresidential projects to use nearby rail for goods movement.
Social Awareness/Education								
MM S-1: GHG Emissions Reductions Education	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile, Stationary, & Mobile	NA/Low	Yes	Yes	Yes: Similar programs currently exist in CA.	Adverse: No Beneficial: CAPs, TACs		Provide local governments, businesses, and residents with guidance/protocols/information on how to reduce GHG emissions (e.g., energy saving, food miles).
MM S-2: School Curriculum	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile, Stationary, & Mobile	NA/Low	Yes	Yes	Yes: Similar programs currently exist in CA.	Adverse: No Beneficial: CAPs, TACs		Include how to reduce GHG emissions (e.g., energy saving, food miles) in the school curriculum.
Construction								
MM C-1: ARB-Certified Diesel Construction Equipment	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	NA/Low	Yes: Oxidation Catalysts, $1,000-	Yes	Yes	Adverse: Yes, NO_x Beneficial: CAPs, TACs	AG, EPA, ARB, and CA air quality management and pollution control districts.	Use ARB-certified diesel construction equipment. Increases CO_2 emissions when trapped CO and carbon particles

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			$2,000. DPF, $5000-$10,000; installation extra (EPA 2007b).					are oxidized (Catalyst Products 2007, ETC 2007).
MM C-2: Alternative Fuel Construction Equipment	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	NA/Low	Yes	Yes	Yes	Adverse: Yes, THC, NO_x Beneficial: CO, PM, SO_x	AG, EPA, ARB, and CA air quality management and pollution control districts.	Use alternative fuel types for construction equipment. At the tailpipe biodiesel emits 10% more CO_2 than petroleum diesel. Overall lifecycle emissions of CO_2 from 100% biodiesel are 78% lower than those of petroleum diesel (NREL 1998, EPA 2007b).
MM C-3: Local Building Materials	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	NA/Low	Yes	Yes	Yes: Depends on location of building material manufacture sites.	Adverse: No Beneficial: CAPs, TACs		Use locally made building materials for construction of the project and associated infrastructure.
MM C-4: Recycle Demolished Construction Material	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile	NA/Low	Yes	Yes	Yes	Adverse: No Beneficial: CAPs, TACs		Recycle/Reuse demolished construction material. Use locally made building materials for construction of the project and associated infrastructure.

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Miscellaneous								
MM M-1: Off-Site Mitigation Fee Program	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile & Area	NA/Moderate-High: Though there is currently no program in place, the potential for real and quantifiable reductions of GHG emissions could be high if a defensible fee program were designed.	Yes	Yes	No: Program does not exist in CA, but similar programs currently exist (e.g., Carl Moyer Program, SJVAPCD Rule 9510, SMAQMD Off-Site Construction Mitigation Fee Program).	Adverse: No Beneficial: CAPs, TACs		Provide/Pay into an off-site mitigation fee program, which focuses primarily on reducing emissions from existing development and buildings through retro-fit (e.g., increased insulation).
MM M-2: Offset Purchase	LD (R, C, M), I, SP, TP, AQP, RR, P/Mobile, Stationary, & Area	NA/Low	Yes	Yes	No: ARB has not adopted official program, but similar programs	No		Provide/purchase offsets for additional emissions by acquiring carbon credits or engaging in other market "cap and trade" systems.

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					currently exist.			
Regional Transportation Plan Measures								
MM RTP-1: Dedicate High Occupancy Vehicle (HOV) lanes prior to adding capacity to existing highways.	RTP		Yes	Yes	Yes	Adverse: possible local CO Beneficial: regional CAPs, TACs	Caltrans, local government	Evaluate the trip reduction (and GHG reduction) potential of adding HOV lanes prior to adding standard lanes.
MM RTP-2: Implement toll/user fee programs prior to adding capacity to existing highways.	RTP		Yes	Yes	Yes	Adverse: possible local CO. Beneficial: regional CAPs, TACs	Caltrans	Evaluate price elasticity and associated trip reduction (and GHG reduction) potential with adding or increasing tolls prior to adding capacity to existing highways.

Note:
[1] Where LD (R, C, M) =Land Development (Residential, Commercial, Mixed-Use), I=Industrial, GP=General Plan, SP=Specific Plan, TP=Transportation Plans, AQP=Air Quality Plans, RR=Rules/Regulations, and P=Policy. It is important to note that listed project types may not be directly specific to the mitigation measure (e.g., TP, AQP, RR, and P) as such could apply to a variety of source types, especially RR and P.
[2] This score system entails ratings of high, moderate, and low that refer to the level of the measure to provide a substantive, reasonably certain (e.g., documented emission reductions with proven technologies), and long-term reduction of GHG emissions.
[3] Refers to whether the measure would provide a cost-effective reduction of GHG emissions based on available documentation.
[4] Refers to whether the measure is based on currently, readily available technology based on available documentation.
[5] Refers to whether the measure could be implemented without extraordinary effort based on available documentation.
[6] List is not meant to be all inclusive.
Source: Data complied by EDAW in 2007

Table 17 General Planning Level Mitigation Strategies Summary			
Strategy	Source Type[1]	Agency/Organization[2]	Description/Comments
MS G-1: Adopt a GHG reduction plan	GP/ Mobile, Stationary, & Area	City of San Bernardino	- Adopt GHG reduction targets for the planning area, based on the current legislation providing direction for state-wide targets, and update the plan as necessary. -The local government agency should serve as a model by inventorying its GHG emissions from agency operations, and implementing those reduction goals.
Circulation			
MS G-2: Provide for convenient and safe local travel	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	- Create a gridded street pattern with small block sizes. This promotes walkability through direct routing and ease of navigation. -Maintain a high level of connectivity of the roadway network. Minimize cul-de-sacs and incomplete roadway segments. -Plan and maintain an integrated, hierarchical and multi-modal system of roadways, pedestrian walks, and bicycle paths throughout the area. -Apply creative traffic management approaches to address congestion in areas with unique problems, particularly on roadways and intersections in the vicinity of schools in the morning and afternoon peak hours, and near churches, parks and community centers. -Work with adjacent jurisdictions to address the impacts of regional development patterns (e.g. residential development in surrounding communities, regional universities, employment centers, and commercial developments) on the circulation system. -Actively promote walking as a safe mode of local travel, particularly for children attending local schools. -Employ traffic calming methods such as median landscaping and provision of bike or transit lanes to slow traffic, improve roadway capacity, and address safety issues.
MS G-3: Enhance the regional transportation network and maintain effectiveness	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Encourage the transportation authority to reduce fees for short distance trips. -Ensure that improvements to the traffic corridors do not negatively impact the operation of local roadways and land uses.

Table 17 General Planning Level Mitigation Strategies Summary			
Strategy	Source Type[1]	Agency/Organization[2]	Description/Comments
			-Cooperate with adjacent jurisdictions to maintain adequate service levels at shared intersections and to provide adequate capacity on regional routes for through traffic. -Support initiatives to provide better public transportation. Work actively to ensure that public transportation is part of every regional transportation corridor. - Coordinate the different modes of travel to enable users to transfer easily from one mode to another. -Work to provide a strong paratransit system that promotes the mobility of all residents and educate residents about local mobility choices. - Promote transit-oriented development to facilitate the use of the community's transit services.
MS G-4: Promote and support an efficient public transportation network connecting activity centers in the area to each other and the region.	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Promote increased use of public transportation and support efforts to increase bus service range and frequency within the area as appropriate. -Enhance and encourage provision of attractive and appropriate transit amenities, including shaded bus stops, to encourage use of public transportation. -Encourage the school districts, private schools and other operators to coordinate local bussing and to expand ride-sharing programs. All bussing options should be fully considered before substantial roadway improvements are made in the vicinity of schools to ease congestion.
MS G-5: Establish and maintain a comprehensive system, which is safe and convenient, of pedestrian ways and bicycle routes that provide viable options to travel by automobile.	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Improve area sidewalks and rights-of-way to make them efficient and appealing for walking and bicycling safely. Coordinate with adjacent jurisdictions and regional agencies to improve pedestrian and bicycle trails, facilities, signage, and amenities. -Provide safe and convenient pedestrian and bicycle connections to and from town centers, other commercial districts, office complexes, neighborhoods, schools, other major activity centers, and surrounding communities. -Work with neighboring jurisdictions to provide well-designed pedestrian and bicycle crossings of major roadways. -Promote walking throughout the community. Install sidewalks where missing and make improvements

Table 17 General Planning Level Mitigation Strategies Summary			
Strategy	Source Type[1]	Agency/Organization[2]	Description/Comments
			to existing sidewalks for accessibility purposes. Particular attention should be given to needed sidewalk improvement near schools and activity centers. -Encourage businesses or residents to sponsor street furniture and landscaped areas. - Strive to provide pedestrian pathways that are well shaded and pleasantly landscaped to encourage use. - Attract bicyclists from neighboring communities to ride their bicycles or to bring their bicycles on the train to enjoy bicycling around the community and to support local businesses. - Meet guidelines to become nationally recognized as a Bicycle-Friendly community. - Provide for an education program and stepped up code enforcement to address and minimize vegetation that degrades access along public rights-of-way. -Engage in discussions with transit providers to increase the number of bicycles that can be accommodated on buses
MS G-6: Achieve optimum use of regional rail transit.	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Support regional rail and work with rail authority to expand services. - Achieve better integration of all transit options. -Work with regional transportation planning agencies to finance and provide incentives for multimodal transportation systems. - Promote activity centers and transit-oriented development projects around the transit station.
MS G-7: Expand and optimize use of local and regional bus and transit systems.	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Encourage convenient public transit service between area and airports. -Support the establishment of a local shuttle to serve commercial centers. -Promote convenient, clean, efficient, and accessible public transit that serves transit-dependent riders and attracts discretionary riders as an alternative to reliance on single-occupant automobiles.

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			- Empower seniors and those with physical disabilities who desire maximum personal freedom and independence of lifestyle with unimpeded access to public transportation. -Integrate transit service and amenities with surrounding land uses and buildings.
Conservation, Open Space			
MS G-8: Emphasize the importance of water conservation and maximizing the use of native, low-water landscaping.	GP/Stationary & Area	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Reduce the amount of water used for landscaping and increase use of native and low water plants. Maximize use of native, low-water plants for landscaping of areas adjacent to sidewalks or other impermeable surfaces. -Encourage the production, distribution and use of recycled and reclaimed water for landscaping projects throughout the community, while maintaining urban runoff water quality objectives. -Promote water conservation measures, reduce urban runoff, and prevent groundwater pollution within development projects, property maintenance, area operations and all activities requiring approval. -Educate the public about the importance of water conservation and avoiding wasteful water habits. -Work with water provider in exploring water conservation programs, and encourage the water provider to offer incentives for water conservation.
MS G-9: Improve air quality within the region.	GP/ Mobile, Stationary, & Area	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Integrate air quality planning with area land use, economic development and transportation planning efforts. -Support programs that reduce air quality emissions related to vehicular travel. -Support alternative transportation modes and technologies, and develop bike- and pedestrian-friendly neighborhoods to reduce emissions associated with automobile use. -Encourage the use of clean fuel vehicles. -Promote the use of fuel-efficient heating and cooling equipment and other appliances, such as water

Table 17 General Planning Level Mitigation Strategies Summary			
Strategy	Source Type[1]	Agency/Organization[2]	Description/Comments
			heaters, swimming pool heaters, cooking equipment, refrigerators, furnaces, and boiler units. - Promote the use of clean air technologies such as fuel cell technologies, renewable energy sources. UV coatings, and alternative, non-fossil fuels. -Require the planting of street trees along streets and inclusion of trees and landscaping for all development projects to help improve airshed and minimize urban heat island effects. - Encourage small businesses to utilize clean, innovative technologies to reduce air pollution. - Implement principles of green building. - Support jobs/housing balance within the community so more people can both live and work within the community. To reduce vehicle trips, encourage people to telecommute or work out of home or in local satellite offices.
MS G-10: Encourage and maximize energy conservation and identification of alternative energy sources.	GP/ Stationary & Area	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Encourage green building designs for new construction and renovation projects within the area. -Coordinate with regional and local energy suppliers to ensure adequate supplies of energy to meet community needs, implement energy conservation and public education programs, and identify alternative energy sources where appropriate. -Encourage building orientations and landscaping that enhance natural lighting and sun exposure. -Encourage expansion of neighborhood-level products and services and public transit opportunities throughout the area to reduce automobile use. - Incorporate the use of energy conservation strategies in area projects. - Promote energy-efficient design features, including appropriate site orientation, use of light color roofing and building materials, and use of evergreen trees and wind-break trees to reduce fuel consumption for heating and cooling.

Table 17 General Planning Level Mitigation Strategies Summary			
Strategy	Source Type[1]	Agency/Organization[2]	Description/Comments
			-Explore and consider the cost/benefits of alternative fuel vehicles including hybrid, natural gas, and hydrogen powered vehicles when purchasing new vehicles. -Continue to promote the use of solar power and other energy conservation measures. - Encourage residents to consider the cost/benefits of alternative fuel vehicles. - Promote the use of different technologies that reduce use of non-renewable energy resources. -Facilitate the use of green building standards and LEED in both private and public projects. -Promote sustainable building practices that go beyond the requirements of Title 24 of the California Administrative Code, and encourage energy-efficient design elements, as appropriate. -Support sustainable building practices that integrate building materials and methods that promote environmental quality, economic vitality, and social benefit through the design, construction, and operation of the built environment. - Investigate the feasibility of using solar (photovoltaic) street lights instead of conventional street lights that are powered by electricity in an effort to conserve energy. - Encourage cooperation between neighboring development to facilitate on-site renewable energy supplies or combined heat and power co-generation facilities that can serve the energy demand of contiguous development.

Table 17 General Planning Level Mitigation Strategies Summary			
Strategy	Source Type[1]	Agency/Organization[2]	Description/Comments
MS G-11: Preserve unique community forests, and provide for sustainable increase and maintenance of this valuable resource.	GP/Stationary & Area	Cities/Counties (e.g., Aliso Viejo, Claremont)	- Develop a tree planting policy that strives to accomplish specific % shading of constructed paved and concrete surfaces within five years of construction. -Provide adequate funding to manage and maintain the existing forest, including sufficient funds for tree planting, pest control, scheduled pruning, and removal and replacement of dead trees. -Coordinate with local and regional plant experts in selecting tree species that respect the natural region in which Claremont is located, to help create a healthier, more sustainable urban forest. - Continue to plant new trees (in particular native tree species where appropriate), and work to preserve mature native trees. -Increase the awareness of the benefits of street trees and the community forest through a area wide education effort. -Encourage residents to properly care for and preserve large and beautiful trees on their own private property.
Housing			
MS G-12: Provide affordability levels to meet the needs of community residents.	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Encourage development of affordable housing opportunities throughout the community, as well as development of housing for elderly and low and moderate income households near public transportation services. -Ensure a portion of future residential development is affordable to low and very low income households.
Land Use			
MS G-13: Promote a visually-cohesive urban form and establish connections between the urban core and outlying portions of the	GP/ Mobile, Stationary, & Area	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Preserve the current pattern of development that encourages more intense and higher density development at the core of the community and less intense uses radiating from the central core. -Create and enhance landscaped greenway, trail and sidewalk connections between neighborhoods and to commercial areas, town centers, and parks.

Table 17 General Planning Level Mitigation Strategies Summary			
Strategy	Source Type[1]	Agency/Organization[2]	Description/Comments
community.			-Identify ways to visually identify and physically connect all portions of the community, focusing on enhanced gateways and unifying isolated and/or outlying areas with the rest of the area. -Study and create a diverse plant identity with emphasis on drought-resistant native species.
MS G-14: Provide a diverse mix of land uses to meet the future needs of all residents and the business community.	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Attract a broad range of additional retail, medical, and office uses providing employment at all income levels. -Support efforts to provide beneficial civic, religious, recreational, cultural and educational opportunities and public services to the entire community. -Coordinate with public and private organizations to maximize the availability and use of parks and recreational facilities in the community. -Support development of hotel and recreational commercial land uses to provide these amenities to local residents and businesses.
MS G-15: Collaborate with providers of solid waste collection, disposal and recycling services to ensure a level of service that promotes a clean community and environment.	GP/ Stationary, & Area	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Require recycling, composting, source reduction and education efforts throughout the community, including residential, businesses, industries, and institutions, within the construction industry, and in all sponsored activities.
MS G-16: Promote construction, maintenance and active use of publicly- and privately-operated parks, recreation programs, and a community center.	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Work to expand and improve community recreation amenities including parks, pedestrian trails and connections to regional trail facilities. -As a condition upon new development, require payment of park fees and/or dedication and provision of parkland, recreation facilities and/or multi-use trails that improve the public and private recreation system. -Research options or opportunities to provide necessary or desired community facilities.

Table 17 General Planning Level Mitigation Strategies Summary			
Strategy	Source Type[1]	Agency/Organization[2]	Description/Comments
MS G-17: Promote the application of sustainable development practices.	GP/ Mobile, Stationary, & Area	Cities/Counties (e.g., Aliso Viejo, Claremont)	- Encourage sustainable development that incorporates green building best practices and involves the reuse of previously developed property and/or vacant sites within a built-up area. - Encourage the conservation, maintenance, and rehabilitation of the existing housing stock. -Encourage development that incorporates green building practices to conserve natural resources as part of sustainable development practices. -Avoid development of isolated residential areas in the hillsides or other areas where such development would require significant infrastructure investment, adversely impact biotic resources. - Provide land area zoned for commercial and industrial uses to support a mix of retail, office, professional, service, and manufacturing businesses.
MS G-18: Create activity nodes as important destination areas, with an emphasis on public life within the community.	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Provide pedestrian amenities, traffic-calming features, plazas and public areas, attractive streetscapes, shade trees, lighting, and retail stores at activity nodes. -Provide for a mixture of complementary retail uses to be located together to create activity nodes to serve adjacent neighborhoods and to draw visitors from other neighborhoods and from outside the area.
MS G-19: Make roads comfortable, safe, accessible, and attractive for use day and night.	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Provide crosswalks and sidewalks along streets that are accessible for people with disabilities and people who are physically challenged. -Provide lighting for walking and nighttime activities, where appropriate. -Provide transit shelters that are comfortable, attractive, and accommodate transit riders.
MS G-20: Maintain and expand where possible the system of neighborhood connections that attach neighborhoods to larger roadways.	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	- Provide sidewalks where they are missing, and provide wide sidewalks where appropriate with buffers and shade so that people can walk comfortably. -Make walking comfortable at intersections through traffic-calming, landscaping, and designated crosswalks.

Table 17 General Planning Level Mitigation Strategies Summary			
Strategy	Source Type[1]	Agency/Organization[2]	Description/Comments
			-Look for opportunities for connections along easements & other areas where vehicles not permitted.
MS G-21: Create distinctive places throughout the area.	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	-Provide benches, streetlights, public art, and other amenities in public areas to attract pedestrian activities. -Encourage new developments to incorporate drought tolerant and native landscaping that is pedestrian friendly, attractive, and consistent with the landscaped character of area. -Encourage all new development to preserve existing mature trees. -Encourage streetscape design programs for commercial frontages that create vibrant places which support walking, bicycling, transit, and sustainable economic development. -Encourage the design and placement of buildings on lots to provide opportunities for natural systems such as solar heating and passive cooling. - Ensure that all new industrial development projects are positive additions to the community setting, provide amenities for the comfort of the employees such as outdoor seating area for breaks or lunch, and have adequate landscape buffers.
MS G-22: Reinvest in existing neighborhoods and promote infill development as a preference over new, greenfield development	GP/ Mobile, Stationary, & Area	Cities/Counties (e.g., Aliso Viejo, Claremont)	- Identify all underused properties in the plan area and focus development in these opportunity sites prior to designating new growth areas for development. - Implement programs to retro-fit existing structures to make them more energy-efficient. -Encourage compact development, by placing the desired activity areas in smaller spaces.

Table 17
General Planning Level Mitigation Strategies Summary

Strategy	Source Type[1]	Agency/Organization[2]	Description/Comments
Public Safety			
MS G-23: Promote a safe community in which residents can live, work, shop, and play.	GP/ Mobile	Cities/Counties (e.g., Aliso Viejo, Claremont)	- Foster an environment of trust by ensuring non-biased policing, and by adopting policies and encouraging collaboration that creates transparency. - Facilitate traffic safety for motorists and pedestrians through proper street design and traffic monitoring.

Note:
[1] Where GP=General Plan.
[2] List is not meant to be all inclusive.
Source: Data complied by EDAW in 2007

Appendix C

Rule and Regulation Summary

Table 18 Rule and Regulation Summary					
Rule/Regulation	Reduction	Implementation Date	Agency	Description	Comments
Low Carbon Fuel Standard	10-20 MMT CO_2e by 2020	January 1, 2010	ARB	This rule/regulation will require fuel providers (e.g., producers, importers, refiners and blenders) to ensure that the mix of fuels they sell in CA meets the statewide goal to reduce the carbon intensity of CA's transportation fuels by at least 10% by the 2020 target.	ARB Early Action Measure
Reduction of HFC-134a Emissions from Nonprofessional Servicing of Motor Vehicle Air Conditioning Systems	1-2 MMT CO_2e by 2020	January 1, 2010	ARB	This rule/regulation will restrict the use of high GWP refrigerants for nonprofessional recharging of leaky automotive air conditioning systems.	ARB Early Action Measure
Landfill Gas Recovery	2-4 MMT CO_2e by 2020	January 1, 2010	IWMB, ARB	This rule/regulation will require landfill gas recovery systems on small to medium landfills that do not have them and upgrade the requirements at landfills with existing systems to represent best capture and destruction efficiencies.	ARB Early Action Measure
Vehicle Climate Change Standards (AB 1493 Pavley, Chapter 200, Statutes of 2002)	30 MMT CO_2e by 2020	2009	ARB	This rule/regulation will require ARB to achieve the maximum feasible and cost effective reduction of GHG emissions from passenger vehicles and light-duty trucks.	ARB Early Action Measure
Reduction of PFCs from the Semiconductor Industry	0.5 MMT CO_2e by 2020	2007–2009	ARB	This rule/regulation will reduce GHG emissions by process improvements/source reduction, alternative chemicals capture and beneficial reuse, and destruction technologies	Underway or to be initiated by CAT members in 2007-2009 period

AB=Assembly Bill; ARB=California Air Resources Board; Calfire=California Fire; CA=California; Caltrans=California Department of Transportation; CAT=California Action Team; CEC=California Energy Commission; CDFA=California Department of Food and Agriculture; CH_4=Methane; CO_2=Carbon Dioxide; CPUC=California Public Utilities Commission; CUFR=California Urban Forestry; DGS=Department of General Services; DWR=Department of Water Resources; GHG=Greenhouse Gas; GWP=Global Warming Potential; IGCC= Integrated Gasification Combined Cycle; IOU= Investor-Owned Utility; IT=Information Technology; IWCB= Integrated Waste Management Board; LNG= Liquefied Natural Gas; MMT CO_2e=Million Metric Tons Carbon Dioxide Equivalent; MW=Megawatts; NA=Not Available; N_2O=Nitrous Oxide; PFC= Perfluorocompound; POU= Publicly Owned Utility; RPS= Renewable Portfolio Standards; RTP=Regional Transportation Plan SB=Senate Bill; SWP=State Water Project; TBD=To Be Determined; UC/CSU=University of California/California State University; ULEV=Ultra Low Emission Vehicle.

Table 18 Rule and Regulation Summary					
Rule/Regulation	Reduction	Implementation Date	Agency	Description	Comments
Restrictions on High GWP Refrigerants	9 MMT CO_2e by 2020	2010	ARB	This rule/regulation will expand and enforce the national ban on release of high GWP refrigerants during appliance lifetime.	ARB Early Action Measure
Cement Manufacture	<1 MMT CO_2e per year (based on 2004 production levels)	2010	Caltrans	This rule/regulation will allow 2.5% interground limestone concrete mix in cement use.	CAT Early Action Measure
Hydrogen Fuel Standards (SB 76 of 2005)	TBD	By 2008	CDFA	This rule/regulation will develop hydrogen fuel standards for use in combustion systems and fuel cells.	CAT Early Action Measure
Regulation of GHG from Load Serving Entities (SB 1368)	15 MMT CO_2e by 2020	May 23, 2007	CEC, CPUC	This rule/regulation will establish a GHG emission performance standard for baseload generation of local publicly owned electric utilities that is no higher than the rate of emissions of GHG for combined-cycle natural gas baseload generation.	CAT Early Action Measure
Energy Efficient Building Standards	TBD	In 2008	CEC	This rule/regulation will update of Title 24 standards.	CAT Early Action Measure
Energy Efficient Appliance Standards	TBD	January 1, 2010	CEC	This rule/regulation will regulate light bulb efficiency	CAT Early Action Measure
Tire Efficiency (Chapter 8.7 Division 15 of the Public Resources Code)	<1 MMT CO_2e by 2020	January 1, 2010	CEC & IWMB	This rule/regulation will ensure that replacement tires sold in CA are at least as energy efficient, on average, as tires sold in the state as original equipment on these vehicles.	CAT Early Action Measure
New Solar Homes Partnership	TBD	January 2007	CEC	Under this rule/regulation, approved solar systems will receive incentive funds based on system performance above building standards.	CAT Early Action Measure

Table 18 Rule and Regulation Summary					
Rule/Regulation	Reduction	Implementation Date	Agency	Description	Comments
Water Use Efficiency	1 MMT CO_2e by 2020	2010	DWR	This rule/regulation will adopt standards for projects and programs funded through water bonds that would require consideration of water use efficiency in construction and operation.	CAT Early Action Measure
State Water Project	TBD	2010	DWR	This rule/regulation will include feasible and cost effective renewable energy in the SWP's portfolio.	CAT Early Action Measure
Cleaner Energy for Water Supply	TBD	2010	DWR	Under this rule/regulation, energy supply contracts with conventional coal power plants will not be renewed.	CAT Early Action Measure
IOU Energy Efficiency Programs	4 MMT CO_2e by 2020	2010	CPUC	This rule/regulation will provide a risk/reward incentive mechanism for utilities to encourage additional investment in energy efficiency; evaluate new technologies and new measures like encouraging compact fluorescent lighting in residential and commercial buildings	CAT Early Action Measure
Solar Generation	TBD	2007–2009	DGS	3 MW of clean solar power generation implemented in CA last year, with another 1 MW coming up. The second round is anticipated to total additional 10 MW and may include UC/CSU campuses and state fairgrounds.	Underway or to be initiated by CAT members in 2007-2009 period

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Table 18 Rule and Regulation Summary					
Rule/Regulation	Reduction	Implementation Date	Agency	Description	Comments
Transportation Efficiency	9 MMT CO_2e by 2020	2007–2009	Caltrans	This rule/regulation will reduce congestion, improve travel time in congested corridors, and promote coordinated, integrated land use.	Underway or to be initiated by CAT members in 2007-2009 period
Smart Land Use and Intelligent Transportation	10 MMT CO_2e by 2020	2007–2009	Caltrans	This rule/regulation will integrate consideration of GHG reduction measures and energy efficiency factors into RTPs, project development etc.	Underway or to be initiated by CAT members in 2007-2009 period
Cool Automobile Paints	1.2 to 2.0 MMT CO_2e by 2020	2009	ARB	Cool paints would reduce the solar heat gain in a vehicle and reduce air conditioning needs.	ARB Early Action Measure
Tire Inflation Program	TBD	2009	ARB	This rule/regulation will require tires to be checked and inflated at regular intervals to improve fuel economy.	ARB Early Action Measure
Electrification of Stationary Agricultural Engines	0.1 MMT CO_2e by 2020	2010	ARB	This rule/regulation will provide incentive funding opportunities for replacing diesel engines with electric motors.	ARB Early Action Measure
Desktop Power Management	Reduce energy use by 50%	2007–2009	DGS, ARB	This rule/regulation will provide software to reduce electricity use by desktop computers by up to 40%.	Currently deployed in DGS
Reducing CH_4 Venting/Leaking from Oil and Gas Systems (EJAC-3/ARB 2-12)	1 MMT CO_2e by 2020	2010	ARB	This rule/regulation will reduce fugitive CH_4 emissions from production, processing, transmission, and distribution of natural gas and oil.	ARB Early Action Measure
Replacement of High GWP Gases Used in Fire Protection Systems with Alternate Chemical (ARB 2-10)	0.1 MMT CO_2e by 2020	2011	ARB	This rule/regulation will require the use of lower GWP substances in fire protection systems.	ARB Early Action Measure
Contracting for Environmentally Preferable Products	NA	2007–2009	DGS	New state contracts have been or are being created for more energy and resource efficient IT goods, copiers, low mercury fluorescent lamps, the CA Gold Carpet Standard and office furniture.	Underway or to be initiated by CAT members in 2007-2009 period
Hydrogen Fuel Cells	NA	2007–2009	DGS	This rule/regulation will incorporate clean hydrogen fuel cells in stationary applications	Underway or to be initiated by CAT members in 2007-2009

Table 18 Rule and Regulation Summary					
Rule/Regulation	Reduction	Implementation Date	Agency	Description	Comments
				at State facilities and as back-up generation for emergency radio services.	period
High Performance Schools	NA	2007–2009	DGS	New guidelines adopted for energy and resource efficient schools; up to $100 million in bond money for construction of sustainable, high performance schools.	Underway or to be initiated by CAT members in 2007-2009 period
Urban Forestry	1 MMT CO_2e by 2020	2007–2009	Calfire, CUFR	This rule/regulation will provide five million additional trees in urban areas by 2020.	Underway or to be initiated by CAT members in 2007-2009 period
Fuels Management/Biomass	3 MMT CO_2e by 2020	2007–2009	Calfire	This rule/regulation will provide biomass from forest fuel treatments to existing biomass utilization facilities.	Underway or to be initiated by CAT members in 2007-2009 period
Forest Conservation and Forest Management	10 MMT CO_2e by 2020	2007–2009	Calfire, WCB	This rule/regulation will provide opportunities for carbon sequestration in Proposition 84 forest land conservation program to conserve an additional 75,000 acres of forest landscape by 2010.	Underway or to be initiated by CAT members in 2007-2009 period
Afforestation/Reforestation	2 MMT CO_2e by 2020	2007–2009	Calfire	This rule/regulation will subsidize tree planting.	Underway or to be initiated by CAT members in 2007-2009 period
Dairy Digesters	TBD	January 1, 2010	CDFA	This rule/regulation will develop a dairy digester protocol to document GHG emission reductions from these facilities.	ARB Early Action Measure

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Table 18
Rule and Regulation Summary

Rule/Regulation	Reduction	Implementation Date	Agency	Description	Comments
Conservation Tillage and Enteric Fermentation	1 MMT CO_2e by 2020	2007–2009	CDFA	This rule/regulation will develop and implement actions to quantify and reduce enteric fermentation emissions from livestock and sequester soil carbon using cover crops and conservation tillage.	Underway or to be initiated by CAT members in 2007-2009 period
ULEV	TBD	2007–2009	DGS	A new long term commercial rental contract was released in March 2007 requiring a minimum ULEV standard for gasoline vehicles and requires alternative fuel and hybrid-electric vehicles.	Underway or to be initiated by CAT members in 2007-2009 period
Flex Fuel Vehicles	370 metric tons CO_2, 0.85 metric tons of CH_4, and 1.14 metric tons of N_2O	2007–2009	DGS	Under this rule/regulation, DGS is replacing 800 vehicles with new, more efficient vehicles.	Underway or to be initiated by CAT members in 2007-2009 period
Climate Registry	TBD	2007–2009	DGS	Benchmarking and reduction of GHG emissions for state owned buildings, leased buildings and light duty vehicles.	Underway or to be initiated by CAT members in 2007-2009 period
Municipal Utilities Electricity Sector Carbon Policy	Included in SB 1368 reductions	2007–2009	CEC, CPUC, ARB	Under this rule/regulation, GHG emissions cap policy guidelines for CA's electricity sector (IOUs and POUs).	Underway or to be initiated by CAT members in 2007-2009 period
Alternative Fuels: Nonpetroleum Fuels	TBD	2007–2009	CEC	State plan to increase the use of alternative fuels for transportation; full fuel cycle assessment.	Underway or to be initiated by CAT members in 2007-2009 period
Zero Waste/High Recycling Strategy	5 MMT CO_2e by 2020	2007–2009	IWMB	This rule/regulation will identify materials to focus on to achieve GHG reduction at the lowest possible cost; Builds on the success of 50% Statewide Recycling Goal.	Underway or to be initiated by CAT members in 2007-2009 period
Organic Materials Management	TBD	2007–2009	IWMB	This rule/regulation will develop a market incentive program to increase organics diversion to the agricultural industry.	Underway or to be initiated by CAT members in 2007-2009 period
Landfill Gas Energy	TBD	2007–2009	IWMB	Landfill Gas to Energy & LNG/biofuels	Underway or to be initiated by CAT members in 2007-2009 period

Table 18
Rule and Regulation Summary

Rule/Regulation	Reduction	Implementation Date	Agency	Description	Comments
Target Recycling	TBD	2007–2009	IWMB	This rule/regulation will focus on industry/public sectors with high GHG components to implement targeted commodity recycling programs.	Underway or to be initiated by CAT members in 2007-2009 period
Accelerated Renewable Portfolio Standard	Included in SB 1368 reductions	2007–2009	CPUC	This rule/regulation will examine RPS long term planning and address the use of tradable renewable energy credits for RPS compliance.	Underway or to be initiated by CAT members in 2007-2009 period
CA Solar Initiative	1 MMT CO_2e by 2020	2007–2009	CPUC	Initiative to deliver 2000 MWs of clean, emissions free energy to the CA grid by 2016.	Underway or to be initiated by CAT members in 2007-2009 period
Carbon Capture and Sequestration	TBD	2007–2009	CPUC	Proposals for power plants with IGCC and/or carbon capture in the next 18 months.	Underway or to be initiated by CAT members in 2007-2009

Source: Data complied by EDAW in 2007

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Technical Advisory

CEQA AND CLIMATE CHANGE: Addressing Climate Change Through California Environmental Quality Act (CEQA) Review

This technical advisory is one in a series of advisories provided by the Governor's Office of Planning and Research (OPR) as a service to professional planners, land use officials and CEQA practitioners. OPR issues technical guidance from time to time on issues that broadly affect the practice of CEQA and land use planning. The emerging role of CEQA in addressing climate change and greenhouse gas emissions has been the topic of much discussion and debate in recent months. This document provides OPR's perspective on the issue.

I. PURPOSE

General scientific consensus and increasing public awareness regarding global warming and climate change have placed new focus on the California Environmental Quality Act (CEQA) review process as a means to address the effects of greenhouse gas (GHG) emissions from proposed projects on climate change. Many public agencies—along with academic, business, and community organizations—are striving to determine the appropriate means by which to evaluate and mitigate the impacts of proposed projects on climate change. Approaches and methodologies for calculating GHG emissions and addressing the environmental impacts through CEQA review are rapidly evolving and are increasingly available to assist public agencies to prepare their CEQA documents and make informed decisions.

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The Governor's Office of Planning and Research (OPR) will develop, and the California Resources Agency (Resources Agency) will certify and adopt amendments to the Guidelines implementing the California Environmental Quality Act ("CEQA Guidelines"), on or before January 1, 2010, pursuant to Senate Bill 97 (Dutton, 2007). These new CEQA Guidelines will provide regulatory guidance on the analysis and mitigation of GHG emissions in CEQA documents. In the interim, OPR offers the following informal guidance regarding the steps lead agencies should take to address climate change in their CEQA documents. This guidance was developed in cooperation with the Resources Agency, the California Environmental Protection Agency (Cal/EPA), and the California Air Resources Board (ARB).

II. BACKGROUND

Climate change refers to any significant change in measures of climate, such as average temperature, precipitation, or wind patterns over a period of time. Climate change may result from natural factors, natural processes, and human activities that change the composition of the atmosphere and alter the surface and features of the land. Significant changes in global climate patterns have recently been associated with global warming, an average increase in the temperature of the atmosphere near the Earth's surface, attributed to accumulation of GHG emissions in the atmosphere. Greenhouse gases trap heat in the atmosphere, which in turn heats the surface of the Earth. Some GHGs occur naturally and are emitted to the atmosphere through natural processes, while others are created and emitted solely through human activities. The emission of GHGs through the combustion of fossil fuels (i.e., fuels containing carbon) in conjunction with other human activities, appears to be closely associated with global warming.

State law defines GHG to include the following: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (Health and Safety Code, section 38505(g).) The most common GHG that results from human activity is carbon dioxide, followed by methane and nitrous oxide.

Requirements of AB 32 and SB 97

Assembly Bill 32 (AB 32), the California Global Warming Solutions Act of 2006 (Nunez, 2006), recognizes that California is the source of substantial amounts of GHG emissions. The statute begins with several legislative findings and declarations of intent, including the following:

> Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California. The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snow pack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems. (Health and Safety Code, section 38501.)

In order to avert these consequences, AB 32 establishes a state goal of reducing GHG emissions to 1990 levels by the year 2020 (a reduction of approximately 25 percent from forecast emission levels) with further reductions to follow. The law requires the ARB to establish a program to track and report GHG emissions; approve a scoping plan for achieving the maximum technologically feasible and cost effective reductions from sources of GHG emissions; adopt early reduction measures to begin moving forward; and adopt, implement and enforce regulations – including market mechanisms such as "cap-and-trade" programs – to ensure the required reductions occur. The ARB recently adopted a statewide GHG emissions limit and an emissions inventory, along with requirements to measure, track, and report GHG emissions by the industries it determined to be significant sources of GHG emissions.

CEQA requires public agencies to identify the potentially significant effects on the environment of projects they intend to carry out or approve, and to mitigate significant effects whenever it is feasible to do so. While AB 32 did not amend CEQA to require new analytic processes to account for the environmental impacts of GHG emissions from projects subject to CEQA, it does acknowledge that such emissions cause significant adverse impacts to human health and the environment.

Senate Bill 97, enacted in 2007, amends the CEQA statute to clearly establish that GHG emissions and the effects of GHG emissions are appropriate subjects for CEQA analysis. It directs OPR to develop draft CEQA Guidelines "for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions" by July 1, 2009 and directs the Resources Agency to certify and adopt the CEQA Guidelines by January 1, 2010.

Requirements of CEQA

CEQA is a public disclosure law that requires public agencies to make a

good-faith, reasoned effort, based upon available information, to identify the potentially significant direct and indirect environmental impacts—including cumulative impacts— of a proposed project or activity. The CEQA process is intended to inform the public of the potential environmental effects of proposed government decisions and to encourage informed decision-making by public agencies. In addition, CEQA obligates public agencies to consider less environmentally-damaging alternatives and adopt feasible mitigation measures to reduce or avoid a project's significant impacts.

The lead agency is required to prepare an Environmental Impact Report (EIR), a Mitigated Negative Declaration, or equivalent document, when it determines that the project's impacts on the environment are potentially significant. This determination of significance must be based upon substantial evidence in light of all the information before the agency.

Although the CEQA Guidelines, at Appendix G, provide a checklist of suggested issues that should be addressed in an EIR, neither the CEQA statute nor the CEQA Guidelines prescribe thresholds of significance or particular methodologies for performing an impact analysis. This is left to lead agency judgment and discretion, based upon factual data and guidance from regulatory agencies and other sources where available and applicable. A threshold of significance is essentially a regulatory standard or set of criteria that represent the level at which a lead agency finds a particular environmental effect of a project to be significant. Compliance with a given threshold means the effect normally will be considered less than significant. Public agencies are encouraged but not required to adopt thresholds of significance for environmental impacts. Even in the absence of clearly defined thresholds for GHG emissions, the law requires that such emissions from CEQA projects must be disclosed and mitigated to the extent feasible whenever the lead agency determines that the project contributes to a significant, cumulative climate change impact.

We realize that perhaps the most difficult part of the climate change analysis will be the determination of significance. Although lead agencies typically rely on local or regional definitions of significance for most environmental issues, the global nature of climate change warrants investigation of a statewide threshold of significance for GHG emissions. To this end, OPR has asked ARB technical staff to recommend a method for setting thresholds which will encourage consistency and uniformity in the CEQA analysis of GHG emissions throughout the state. Until such time as state guidance is available on thresholds of significance for GHG emissions, we recommend the following approach to your CEQA analysis.

III. RECOMMENDED APPROACH

Each public agency that is a lead agency for complying with CEQA needs to develop its own approach to performing a climate change analysis for projects that generate GHG emissions. A consistent approach should be applied for the analysis of all such projects, and the analysis must be based on best available information. For these projects, compliance with CEQA entails three basic steps: identify and quantify the GHG emissions; assess the significance of the impact on climate change; and if the impact is found to be significant, identify alternatives and/or mitigation measures that will reduce the impact below significance.

Lead agencies should determine whether greenhouse gases may be generated by a proposed project, and if so, quantify or estimate the GHG emissions by type and source. Second, the lead agency must assess whether those emissions are individually or cumulatively significant. When assessing whether a project's effects on climate change are "cumulatively considerable" even though its GHG contribution may be individually limited, the lead agency must consider the impact of the project when viewed in connection with the effects of past, current, and probable future projects. Finally, if the lead agency determines that the GHG emissions from the project as proposed are potentially significant, it must investigate and implement ways to avoid, reduce, or otherwise mitigate the impacts of those emissions. Although the scientific knowledge and understanding of how best to perform this analysis is rudimentary and still evolving, many useful resources are available (see Attachment 1).

Until such time as further state guidance is available on thresholds of significance, public agencies should consider the following general factors when analyzing whether a proposed project has the potential to cause a significant climate change impact on the environment.

Identify GHG Emissions

- Lead agencies should make a good-faith effort, based on available information, to calculate, model, or estimate the amount of CO_2 and other GHG emissions from a project, including the emissions associated with vehicular traffic, energy consumption, water usage and construction activities.

- Technical resources, including a variety of modeling tools, are available to assist public agencies to quantify GHG emissions. OPR recognizes that more sophisticated emissions models for particular types of projects are

continually being developed and that the state-of-the-art quantification models are rapidly changing. OPR will periodically update the examples of modeling tools identified in Attachment 2.

- There is no standard format for including the analysis in a CEQA document. A GHG/climate change analysis can be included in one or more of the typical sections of an EIR (e.g., air quality, transportation, energy) or may be provided in a separate section on cumulative impacts or climate change.

Determine Significance

- When assessing a project's GHG emissions, lead agencies must describe the existing environmental conditions or setting, without the project, which normally constitutes the baseline physical conditions for determining whether a project's impacts are significant.
- As with any environmental impact, lead agencies must determine what constitutes a significant impact. In the absence of regulatory standards for GHG emissions or other scientific data to clearly define what constitutes a "significant impact", individual lead agencies may undertake a project-by-project analysis, consistent with available guidance and current CEQA practice.
- The potential effects of a project may be individually limited but cumulatively considerable. Lead agencies should not dismiss a proposed project's direct and/or indirect climate change impacts without careful consideration, supported by substantial evidence. Documentation of available information and analysis should be provided for any project that may significantly contribute new GHG emissions, either individually or cumulatively, directly or indirectly (e.g., transportation impacts).
- Although climate change is ultimately a cumulative impact, not every individual project that emits GHGs must necessarily be found to contribute to a significant cumulative impact on the environment. CEQA authorizes reliance on previously approved plans and mitigation programs that have adequately analyzed and mitigated GHG emissions to a less than significant level as a means to avoid or substantially reduce the cumulative impact of a project.

Mitigate Impacts

- Mitigation measures will vary with the type of project being

contemplated, but may include alternative project designs or locations that conserve energy and water, measures that reduce vehicle miles traveled (VMT) by fossil-fueled vehicles, measures that contribute to established regional or programmatic mitigation strategies, and measures that sequester carbon to offset the emissions from the project.

- The lead agency must impose all mitigation measures that are necessary to reduce GHG emissions to a less than significant level. CEQA does not require mitigation measures that are infeasible for specific legal, economic, technological, or other reasons. A lead agency is not responsible for wholly eliminating all GHG emissions from a project; the CEQA standard is to mitigate to a level that is "less than significant".
- If there are not sufficient mitigation measures that the lead agency determines are feasible to achieve the less than significant level, the lead agency should adopt those measures that are feasible, and adopt a Statement of Overriding Considerations that explains why further mitigation is not feasible. A Statement of Overriding Considerations must be prepared when the lead agency has determined to approve a project for which certain impacts are unavoidable. These statements should explain the reasons why the impacts cannot be adequately mitigated in sufficient detail, and must be based on specific facts, so as not to be conclusory.
- Agencies are encouraged to develop standard GHG emission reduction or mitigation measures that can be applied on a project-by-project basis. Attachment 3 contains a preliminary menu of measures that lead agencies may wish to consider. This list is by no means exhaustive or prescriptive. Lead agencies are encouraged to develop their own measures and/or propose project alternatives to reduce GHG emissions, either at a programmatic level or on a case-by-case review.
- In some cases GHG emission reduction measures will not be feasible or may not be effective at a project level. Rather, it may be more appropriate and more effective to develop and adopt program-level plans, policies and measures that will result in a reduction of GHG emissions on a regional level.

IV. ADDITIONAL LAND USE CONSIDERATIONS

CEQA can be a more effective tool for GHG emissions analysis and mitigation if it is supported and supplemented by sound development policies and practices that will reduce GHG emissions on a broad planning scale and that

can provide the basis for a programmatic approach to project-specific CEQA analysis and mitigation.

Local governments with land use authority are beginning to establish policies that result in land use patterns and practices that will result in less energy use and reduce GHG emissions. For example, some cities and counties have adopted general plans and policies that encourage the development of compact, mixed-use, transit-oriented development that reduces VMT; encourage alternative fuel vehicle use; conserve energy and water usage; and promote carbon sequestration. Models of such developments exist throughout the state (see OPR climate change website for examples of city and county plans and policies, referenced in Attachment 1).

For local government lead agencies, adoption of general plan policies and certification of general plan EIRs that analyze broad jurisdiction-wide impacts of GHG emissions can be part of an effective strategy for addressing cumulative impacts and for streamlining later project-specific CEQA reviews.

International, national, and statewide organizations such as ICLEI (Local Governments for Sustainability), the Cities for Climate Protection, and the Clean Cities Coalition —to name just a few — have published guidebooks to help local governments reduce GHG emissions through land use planning techniques and improved municipal operations. Links to these resources are provided at the end of this advisory.

Regional agencies can also employ a variety of strategies to reduce GHG emissions through their planning processes. For example, regional transportation planning agencies adopt plans and programs that address congestion relief, jobs-to-housing balance, reduction of vehicle miles traveled (VMT), and other issues that have implications for GHG emission reductions.

State agencies are also tackling the issue of climate change. Some have adopted or support policies and programs that take climate change into account, including the Department of Water Resources' State Water Plan; the Department of Transportation's State Transportation Plan; and the Business, Housing and Transportation Agency's Regional Blueprint Planning Program. These efforts not only raise public awareness of climate change and how the State can reduce GHG emissions, but also offer specific information and resources for lead agencies to consider.

V. NEXT STEPS

OPR has asked ARB technical staff to recommend a method for setting a

threshold of significance for GHG emissions. OPR has requested that the ARB identify a range of feasible options, including qualitative and quantitative options.

OPR is actively seeking input from the public and stakeholder groups, as it develops draft CEQA Guidelines for GHG emissions. OPR is engaged with the Resources Agency and other expert state agencies, local governments, builders and developers, environmental organizations, and others with expertise or an interest in the development of the Guidelines.

OPR will conduct public workshops later this year to receive input on the scope and content of the CEQA Guidelines amendments. It is OPR's intent to release a preliminary draft of the CEQA Guidelines amendments for public review and comment in the fall. This will enable OPR to deliver a proposed package of CEQA Guidelines amendments to the Resources Agency as early as January 2009, well before the statutory due date of July 1, 2009.

We encourage public agencies and the public to refer to the OPR website at www.opr.ca.gov for information about the CEQA Guidelines development process and to subscribe to OPR's notification system for announcements and updates.

For more information about this technical advisory and assistance in addressing the impacts of GHG emissions on the environment, please contact:

Governor's Office of Planning and Research
State Clearinghouse
1400 Tenth Street
P.O. Box 3044
Sacramento, CA 95812-3044
Telephone: (916) 445-0613
Fax: (916) 323-3018
Web Address: www.opr.ca.gov

ATTACHMENTS

1. References and Information Sources
2. Technical Resources/Modeling Tools to Estimate GHG Emissions
3. Examples of GHG Reduction Measures

Attachment 1

References and Information Sources

The following is a list of websites of organizations that can offer additional information regarding methods to characterize, quantify, assess and reduce GHG emissions. In addition, a list of useful resources and reference materials is provided on the subject of climate change and greenhouse gases.

ORGANIZATIONS

- Governor's Office of Planning and Research
  http://www.opr.ca.gov
- California Climate Action Team
  http://www.climatechange.ca.gov/climate_action_team/
- California Climate Change Portal
  http://www.climatechange.ca.gov
- California Air Resources Board Climate Change Website
  http://www.arb.ca.gov/cc/cc.htm
- California Climate Action Registry
  http://www.climateregistry.org/
- California Department of Water Resources, Climate Change and California Water Plan Website
  http://www.waterplan.water.ca.gov/climate/
- California Energy Commission Climate Change Proceedings
  http://www.energy.ca.gov/global_climate_change/index.html
- California Public Utilities Commission, Climate Change Website
  http://www.cpuc.ca.gov/static/energy/electric/climate+change/_index.htm
- Green California Website
  http://www.green.ca.gov/default.htm
- Western Climate Initiative
  http://www.westernclimateinitiative.org

- California Air Pollution Control Officers Association
  http://www.capcoa.org
- Local Governments for Sustainability (ICLEI)
  http://www.iclei.org/
- ICLEI Cities for Climate Protection (CCP)
  http://www.iclei.org/index.php?id=800
- United Nations Framework Convention on Climate Change
  http://unfccc.int/2860.php
- Intergovernmental Panel on Climate Change
  http://www.ipcc.ch
- United States Environmental Protection Agency
  http://www.epa.gov/climatechange/
- City of Seattle U.S. Mayors Climate Protection Agreement
  http://www.seattle.gov/mayor/climate/
- Mayors for Climate Protection
  http://www..coolmayors.com
- U.S. Conference of Mayors Climate Protection Web Page
  http://usmayors.org/climateprotection
- Institute for Local Government California Climate Action Network
  http://www.ca-ilg.org/climatechange

STATUTES, REGULATIONS, AND EXECUTIVE ORDERS

- SB 97
  http://opr.ca.gov/ceqa/pdfs/SB_97_bill_20070824_chaptered.pdf
- SB 97 Governor's Signing Message
  http://opr.ca.gov/ceqa/pdfs/SB-97-signing-message.pdf
- AB 32
  http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf
- AB 1493
  http://www.leginfo.ca.gov/pub/01-02/bill/asm/ab_1451-1500/ab_1493_bill_20020722_chaptered.pdf

- Regulations implementing AB 1493

  http://www.arb.ca.gov/regact/grnhsgas/revfro.pdf and http://www.arb.ca.gov/regact/grnhsgas/revtp.pdf

- SB 1368

  http://www.leginfo.ca.gov/pub/05-06/bill/sen/sb_1351-1400/sb_1368_bill_20060929_chaptered.pdf

- Executive Order S-01-07 regarding low carbon standard for transportation fuels

  http://gov.ca.gov/index.php?/executive-order/5172/

- Executive Order S-20-06 regarding implementation of AB 32

  http://gov.ca.gov/index.php?/executive-order/4484/

- Executive Order S-3-05 regarding greenhouse gas goals

  http://gov.ca.gov/index.php?/executive-order/1861/

- Executive Order S-20-04 regarding energy conservation by state

  http://gov.ca.gov/index.php?/executive-order/3360/

REPORTS

- OPR List of Environmental Documents Addressing Climate Change

  http://opr.ca.gov/ceqa/pdfs/Environmental_Assessment_Climate_Change.pdf

- OPR List of Local Plans Addressing Climate Change

  http://opr.ca.gov/ceqa/pdfs/City_and_County_Plans_Addressing_Climate_Change.pdf

- *Climate Action Team Proposed Early Action Measures to Mitigate Climate Change in California*, April 2007

  http://www.climatechange.ca.gov/climate_action_team/reports/2007-04-20_CAT_REPORT.PDF

- California Air Resources Board, *Early Action Items to Mitigate Climate Change in California*, October 2007

  http://www.arb.ca.gov/cc/ccea/meetings/ea_final_report.pdf

- California Air Resourced Board, *Draft Greenhouse Gas Inventory*, November 2007

  http://www.arb.ca.gov/cc/inventory/data/tables/rpt_Inventory_IPCC_All_2007-11-19.pdf

- *Climate Action Team Report to the Governor and Legislature*, March 2006, http://www.climatechange.ca.gov/climate_action_team/reports/index.html

- California Climate Change Center, *Our Changing Planet: Assessing the Risks to California - Summary Report*

  http://www.energy.ca.gov/2006publications/CEC-500-2006-077/CEC-500-2006-077.PDF

  Detailed reports available at: http://www.climatechange.ca.gov/biennial_reports/2006report/index.html

- California Energy Commission, *2007 Integrated Energy Policy Report Update*

  http://www.energy.ca.gov/2007publications/CEC-100-2007-008/CEC-100-2007-008-CMF.PDF

- California Department of Water Resources, *Progress on Incorporating Climate Change into Management of California's Water Resources*

  http://baydeltaoffice.water.ca.gov/climatechange/DWRClimateChangeJuly06.pdf - pagemode=bookmarks&page=1

- *Climate Action Program at Caltrans*, December 2006

  http://www.dot.ca.gov/docs/ClimateReport.pdf

- California Air Pollution Control Officers Association, *CEQA & Climate Change,* January 2008

  http://www.capcoa.org/ceqa/CAPCOA%20White%20Paper%20-%20CEQA%20and%20Climate%20Change.pdf

- West Coast Governors' Global Warming Initiative, November 2004

  http://www.climatechange.ca.gov/westcoast/documents/2004-11_final_report/2004-11-18_STAFF_RECOMMENDS.PDF

- Western Climate Initiative Work Plan, October 2007

  http://www.westernclimateinitiative.org/ewebeditpro/items/O104F13792.pdf

- California Climate Change Center, University of California at Berkeley, *Managing Greenhouse Gas Emissions in California,* 2007

  http://calclimate.berkeley.edu/managing_GHGs_in_CA.html

- U.S. Conference of Mayors, *Energy & Environment Best Practices*

  http://www.usmayors.org/climateprotection/AtlantaEESummitCDROMVersion.pdf

- *U.S. Mayors Climate Protection Agreement Climate Action Handbook*, 2006

  http://www.seattle.gov/climate/docs/ClimateActionHandbook.pdf

- Natural Capitalism Solutions *Climate Protection Manual for Cities*, June 2007

  http://www.climatemanual.org

- National Governor's Association Center for Best Practices *Growing with Less Greenhouse Gases*, November 2002

  http://www.nga.org/cda/files/112002ghg.pdf

- National Governor's Association Center for Best Practices *State and Regional Greenhouse Gas* Initiatives, October 2006

  http://www.nga.org/Files/pdf/0610GREENHOUSE.PDF

- United States Climate Change Program *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States*, May 2008

  http://www.usda.gov/oce/global_change/sap_2007_FinalReport.htm

Attachment 2

Technical Resources/Modeling Tools to Estimate GHG Emissions

TOOL	AVAILABILITY	SCOPE LOCAL/ REGIONAL	SCOPE TRANSPORTATION/ BUILDINGS	DATA INPUT REQUIREMENTS	DATA OUTPUT
URBEMIS	• Download • Public domain (free)	• Local project level	• Transportation • Some building (area source) outputs • Construction	• Land use information • Construction, area source, and transportation assumptions	• CO2 (pounds per day) • Mitigation impacts
Clean Air and Climate Protection (CACP) Software	• Download • Available to public agencies (free)	• Local project level	• Buildings • Communities • Governments	• Energy usage • Waste generation and disposal • Transportation fuel usage or VMT	• CO2e (tons per year)
Sustainable Communities Model (SCM)	• Custom model	• Regional • Scalable to site level	• Transportation • Buildings • Neighborhoods • Master planned communities	• Location and site specific information • Transportation assumptions • On-site energy usage	• CO2e (tons per year)
Internet-accessed Planning for Community Energy, Economic and Environmental Sustainability I-PLACE^{3}S	• Web-based • Small access fee • Full model now available in eight CA counties	• Regional • Scalable to site level	• Transportation • Housing • Land Use • Buildings • Energy • Economics	• Parcel level land use data (ability to work with less data) • Project-level data for alternative comparisons	• CO2 (any quantity over any time)

Climate Action Registry Reporting On-Line Tool (CARROT)	• Web-based
	• Available to Registry members
	• General public can view entity reports
		• Regional, scalable to entity and facility level	• General Reporting and Certification Protocols
			  ○ Transportation
			  ○ Buildings/facilities
			• Specific protocols for some sectors
				• Mobile source combustion (VMT or fuel usage)
				• Stationary combustion (fuel usage)
				• Indirect emissions (electricity usage)
					• Each GHG and CO2e (tons per year)

EMFAC	• Download • Public domain (free)	• Statewide • Regional (air basin level)	• Transportation emission factors	• Travel activity data to calculate CO2 from projects.	• CO2 and methane (grams per mile) emission factors

VMT = Vehicle miles traveled
eCO2 = Carbon dioxide equivalent emissions
Note: This is not meant to be a definitive list of modeling tools to estimate climate change emissions impacts. Other tools may be available.

Description of Modeling Tools

URBEMIS

The Urban Emissions Model is used extensively during the CEQA process by local air districts and consultants to determine the impacts of projects on criteria pollutants. It was recently updated to calculate CO2 emissions as well. Future updates will include additional greenhouse gases. URBEMIS uses the ITE Trip Generation Rate Manual and the Air Resources Board's (ARB) motor vehicle emissions model (EMFAC) to calculate transportation-related CO2 emissions and ARB's OFFROAD2007 model for CO2 emissions from off-road equipment. Area source outputs include natural gas use, landscaping equipment, consumer products, architectural coatings, and fireplaces. It also estimates construction impacts and impacts of mitigation options. Web site: http://www.urbemis.com.

Clean Air and Climate Protection (CACP) Software

This tool is available to state and local governments and members of ICLEI, NACAA, NASEO and NARUC to determine greenhouse gas and criteria pollutant emissions from government operations and communities as a whole. The user must input aggregate information about energy (usage), waste (quantity and type generated, disposal method, and methane recovery rate) and transportation (VMT) for community analyses. CACP uses emission factors from EPA, DOE, and DOT to translate the energy, waste and transportation inputs into greenhouse gas (in carbon dioxide equivalents) and criteria air pollutant emissions. If associated energy, waste and transportation reduction are provided, the model can also calculate emission reductions and money saved from policy alternatives. Web site: http://cacpsoftware.org.

Sustainable Communities Model (SCM)

This model quantifies total CO2e emissions allowing communities the ability to optimize planning decisions that result in the greatest environmental benefit for the least cost. Total CO2e emissions are based on emissions from energy usage, water consumption and transportation. The model provides an interactive comparison of various scenarios to provide environmental performance, economic performance, and cost benefit analysis.

Web site: www.ctg-net.com/energetics/documents/doc_SCM_070731.pdf

I-PLACE^{3}S

This model is an internet-accessed land use and transportation model designed specifically for regional and local governments to help understand how their growth and development decisions can contribute to improved sustainability. It estimates CO2, criteria pollutant and energy impacts on a neighborhood or

regional level for existing, long-term baseline and alternative land use plans. The data input requirements are extensive and require a fiscal commitment from the Metropolitan Planning Organization and its member local governments. Once the data is available, the IPLACES tool can be developed for that region relatively quickly, in approximately one week. The benefits include a multifunctional tool that provides immediate outputs to compare alternatives during public meetings, multilevel password protected on-line access, as well as providing access for local development project CEQA analyses. This tool also supports regional travel models and integrated land use and transportation assessments. Web site: http://www.sacregionblueprint.org/sacregionblueprint/the_project/technology.cfm and http://www.places.energy.ca.gov/places

CARROT

The California Climate Action Registry offers the Climate Action Registry Reporting On-Line Tool (CARROT) for Registry members to calculate and report annual greenhouse gas (GHG) emissions. CARROT calculates direct and indirect GHG emissions for the following emission categories by source: stationary combustion, process emissions, mobile source combustion, fugitive emissions and electricity use by source. It calculates emissions using entity collected data such as fuel purchase records, VMT and utility bills. While reporting and certification through CARROT is only available to members, the public may access entity reports online. Reporting protocols are also available to the public, including the General Reporting Protocol (www.climateregistry.org/docs/PROTOCOLS/GRP%20V2-March2007_web.pdf) and cement, forestry and power/utility sector protocols. Additional sector protocols are under development. Website: www.climateregistry.org/CARROT/

EMFAC

The Air Resources Board's EMission FACtors (EMFAC) model is used to calculate emission rates from all motor vehicles in California. The emission factors are combined with data on vehicle activity (miles traveled and average speeds) to assess emission impacts. The URBEMIS model described above uses EMFAC to calculate the transportation emission impacts of local projects. Web site: http://www.arb.ca.gov/msei/onroad/onroad.htm

Attachment 3

Examples of GHG Reduction Measures

The following are examples of measures that have been employed by some public agencies to reduce greenhouse gas emissions, either as general development policies or on a project-by-project basis. These are provided for illustrative purposes only.

LAND USE AND TRANSPORTATION

- Implement land use strategies to encourage jobs/housing proximity, promote transit-oriented development, and encourage high density development along transit corridors. Encourage compact, mixed-use projects, forming urban villages designed to maximize affordable housing and encourage walking, bicycling and the use of public transit systems.
- Encourage infill, redevelopment, and higher density development, whether in incorporated or unincorporated settings
- Encourage new developments to integrate housing, civic and retail amenities (jobs, schools, parks, shopping opportunities) to help reduce VMT resulting from discretionary automobile trips.
- Apply advanced technology systems and management strategies to improve operational efficiency of transportation systems and movement of people, goods and services.
- Incorporate features into project design that would accommodate the supply of frequent, reliable and convenient public transit.
- Implement street improvements that are designed to relieve pressure on a region's most congested roadways and intersections.
- Limit idling time for commercial vehicles, including delivery and construction vehicles.

URBAN FORESTRY

- Plant trees and vegetation near structures to shade buildings and reduce energy requirements for heating/cooling.
- Preserve or replace onsite trees (that are removed due to development) as a means of providing carbon storage.

GREEN BUILDINGS

- Encourage public and private construction of LEED (Leadership in Energy and Environmental Design) certified (or equivalent) buildings.

ENERGY CONSERVATION POLICIES AND ACTIONS

- Recognize and promote energy saving measures beyond Title 24 requirements for residential and commercial projects
- Where feasible, include in new buildings facilities to support the use of low/zero carbon fueled vehicles, such as the charging of electric vehicles from green electricity sources.
- Educate the public, schools, other jurisdictions, professional associations, business and industry about reducing GHG emissions.
- Replace traffic lights, street lights, and other electrical uses to energy efficient bulbs and appliances.
- Purchase Energy Star equipment and appliances for public agency use.
- Incorporate on-site renewable energy production, including installation of photovoltaic cells or other solar options.
- Execute an Energy Savings Performance Contract with a private entity to retrofit public buildings. This type of contract allows the private entity to fund all energy improvements in exchange for a share of the energy savings over a period of time.
- Design, build, and operate schools that meet the Collaborative for High Performance Schools (CHPS) best practices.
- Retrofit municipal water and wastewater systems with energy efficient motors, pumps and other equipment, and recover wastewater treatment methane for energy production.
- Convert landfill gas into energy sources for use in fueling vehicles, operating equipment, and heating buildings.
- Purchase government vehicles and buses that use alternatives fuels or technology, such as electric hybrids, biodiesel, and ethanol. Where feasible, require fleet vehicles to be low emission vehicles. Promote the use of these vehicles in the general community.
- Offer government incentives to private businesses for developing buildings with energy and water efficient features and recycled materials. The incentives can include expedited plan checks and reduced permit fees.
- Offer rebates and low-interest loans to residents that make energy-saving improvements on their homes.

- Create bicycle lanes and walking paths directed to the location of schools, parks and other destination points.

PROGRAMS TO REDUCE VEHICLE MILES TRAVELED

- Offer government employees financial incentives to carpool, use public transportation, or use other modes of travel for daily commutes.
- Encourage large businesses to develop commute trip reduction plans that encourage employees who commute alone to consider alternative transportation modes.
- Develop shuttle systems around business district parking garages to reduce congestion and create shorter commutes.
- Create an online ridesharing program that matches potential carpoolers immediately through email.
- Develop a Safe Routes to School program that allows and promotes bicycling and walking to school.

PROGRAMS TO REDUCE SOLID WASTE

- Create incentives to increase recycling and reduce generation of solid waste by residential users.
- Implement a Construction and Demolition Waste Recycling Ordinance to reduce the solid waste created by new development.
- Add residential/commercial food waste collection to existing greenwaste collection programs.

CALIFORNIA NATURAL RESOURCES AGENCY



INITIAL STATEMENT OF REASONS FOR REGULATORY ACTION

Proposed Amendments to the State CEQA Guidelines Addressing Analysis and Mitigation of Greenhouse Gas Emissions Pursuant to SB97

July 2009

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CALIFORNIA NATURAL RESOURCES AGENCY
INITIAL STATEMENT OF REASONS FOR REGULATORY ACTION

July 2009

INTRODUCTION

The California Natural Resources Agency ("the Resources Agency") is proposing this action to amend and add certain guidelines implementing the California Environmental Quality Act (Public Resources Code section 21000 *et seq.*) ("CEQA"). Specifically, these amendments implement the Legislature's directive in Public Resources Code section 21083.05 (enacted as part of SB97 (Chapter 185, Statutes 2007)). That section directs the Resources Agency to "certify and adopt guidelines prepared and developed by the Office of Planning and Research" "for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions[.]" (Pub. Resources Code, § 21083.05(a)-(b).)

CEQA generally requires public agencies to review the environmental impacts of proposed projects, and, if those impacts may be significant, to consider feasible alternatives and mitigation measures that would substantially reduce significant adverse environmental effects. Section 21083 of the Public Resources Code requires the adoption of guidelines to provide public agencies and members of the public with guidance about the procedures and criteria for implementing CEQA. The guidelines required by section 21083 of the Public Resources Code are promulgated in the California Code of Regulations, title 14, sections 15000-15387 (the "Guidelines" or "State CEQA Guidelines"). At present, public agencies, project proponents, and third parties who wish to enforce the requirements of CEQA, rely on the Guidelines to provide a comprehensive guide on compliance with a lead agency's obligations under CEQA. Subdivision (f) of section 21083 requires the Resources Agency, in consultation with the Office of Planning and Research ("OPR"), to certify, adopt and amend the Guidelines at least once every two years.

Section 21083.05, as noted above, requires the promulgation of Guidelines specifically addressing analysis and mitigation of the effects of greenhouse gas emissions. The Resources Agency proposes the following changes to the Guidelines ("Proposed Amendments") to implement that directive:

Add sections: 15064.4, 15183.5 and 15364.5.

Amend sections: 15064, 15064.7, 15065, 15086, 15093, 15125, 15126.2, 15126.4, 15130, 15150, 15183, Appendix F and Appendix G.

In addition to guidelines implementing SB97, some of the amendments listed above are non-substantive corrections.

The Resources Agency considered reasonable alternatives to the proposed action. The Resources Agency has determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 and to update the Guidelines to reflect recent case law. Thus, the Proposed Amendments add no additional substantive requirements; rather, the Guidelines merely assist lead agencies in complying with CEQA's existing requirements. The Resources Agency rejected the no action alternative because it would not respond to the Legislature's directive in SB97. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts are due to existing requirements of CEQA and not the proposed action.

The Resources Agency has also initially determined that the proposed action will not have a significant adverse economic impact on business. The Resources Agency has determined that the proposed changes in this action have no impacts on project proponents. However, the Resources Agency is aware that certain of the statutory changes enacted by the Legislature and judicial decisions, described in greater detail below, that are reflected in this proposed action could have an economic impact on project proponents, including businesses. Among other things, project proponents could incur additional costs in assisting lead agencies to comply with CEQA's requirement for analysis of greenhouse gas emissions. However, the proposed changes to the Guidelines merely reflect these legislative and judicial requirements, and the Resources Agency knows of no less costly alternative. The proposed action clarifies and updates the Guidelines to be consistent with legislative enactments that have modified CEQA, and recent case law interpreting it, but does not impose any new requirements. Therefore, the proposed action does not itself have a significant, adverse economic impact on business.

The proposed action does not duplicate or conflict with any federal statutes or regulations. CEQA is similar in some respects to the National Environmental Policy Act ("NEPA"), 42 U.S.C. sections 4321-4343. Federal agencies are subject to NEPA, which requires environmental review of federal actions. State and local agencies are subject to CEQA, which requires environmental review before state and local agencies may approve or decide to undertake discretionary actions and projects in California. Although both NEPA and CEQA require an analysis of environmental impacts, the substantive and procedural requirements of the two statutes differ. Most significantly, CEQA requirements for feasible mitigation of environmental impacts exceed NEPA's mitigation provisions. A state or local agency must complete a CEQA review even for those projects for which NEPA review is also applicable, although Guidelines sections 15220-15229 allow state, local and federal agencies to coordinate review when projects are subject to both CEQA and NEPA. Because state and local agencies are subject to CEQA unless exemptions apply, and because CEQA and NEPA are not identical, guidelines for CEQA are necessary to interpret and make specific provisions of SB97 and do not duplicate the Code of Federal Regulations.

Below is a brief background on the science relating to the effects of greenhouse gas emissions, as well as the various initiatives that California is implementing to reduce those emissions. Following that background, OPR's public engagement process is briefly described,. Next, this Initial Statement of Reasons explains the purpose and necessity of each proposed change to the Guidelines. Finally, several issues that are not addressed in these Proposed Amendments are discussed.

BACKGROUND ON THE EFFECTS OF GREENHOUSE GAS EMISSIONS AND CALIFORNIA'S EFFORTS TO REDUCE THOSE EMISSIONS

This section provides a brief background on the potential effects of greenhouse gas emissions and California's efforts to reduce those emissions.

What Are Greenhouse Gases?

Certain gases in Earth's atmosphere naturally trap solar energy to maintain global average temperatures within a range suitable for terrestrial life. Those gases – which primarily include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride – act as a greenhouse on a global scale. (Health and Safety Code, § 38505(g).) Thus, those heat-trapping gases are known as greenhouse gases ("GHG").

The Legislature defined "greenhouse gases" to include the six gases mentioned above in California's Global Warming Solutions Act. (Health & Saf. Code, § 38500 et seq.) Similarly, the U.S. EPA has proposed regulation of those same six gases under the authority of the Clean Air Act. According to the U.S. EPA:

> These six greenhouse gases are well studied by and have been the primary focus of climate change research, and are therefore the Administrator's first priority in addressing endangerment for greenhouse gases. These six greenhouse gases share common physical properties relevant to the climate change problem: all are long-lived in the atmosphere; all become globally well mixed in the atmosphere regardless of where the emissions occur; all trap outgoing heat that would otherwise escape to space; and all are directly emitted as greenhouse gases rather than forming as a greenhouse gas in the atmosphere after emission of a precursor gas. Because of these properties, the climate effects of these greenhouse gases are generally better understood than the climate effects associated with most other climate-forcing agents….

(EPA, Draft Endangerment Finding, 74 Fed. Reg. 18886, 18895 (April 24, 2009) (footnote omitted).) The United Nations Framework Convention on Climate Change also addresses these six gases. (*Ibid.*)

What Causes Greenhouse Gas Emissions?

The incremental contributions of GHGs from immeasurable and innumerable direct and indirect sources result in elevated atmospheric GHG levels. (EPA, Draft Endangerment Finding, 74 Fed. Reg. 18886, 18904 (April 24, 2009) ("cumulative emissions are responsible for the cumulative change in the stock of concentrations in the atmosphere").) Some GHG emissions occur through natural processes such as plant decomposition and wildfires. One large source of GHG emissions, for example, is wildfire on forestlands and rangelands, which release carbon as a result of material being burned. (California Board of Forestry and Fire Protection, *2008 Strategic Plan and Report to the CARB on Meeting AB32 Forestry Sector Targets* (October, 2008), at p. 2.)

Human activities, such as motor vehicle use, energy production and land development, also result in both direct and indirect emissions that have contributed to highly elevated concentrations of GHGs in the atmosphere. (California Energy Commission, *Inventory of California Emissions and Sinks: 1990 to 2004* (2006).)[1] Transportation alone is estimated to account for nearly 40 percent of California's GHG emissions. (California Air Resources Board, *Climate Change Proposed Scoping Plan* (2008), at p. 11 ("Scoping Plan"); California Energy Commission 2007, *2007 Integrated Energy Policy Report*, CEC-100-2007-008-CMF ("2007 IEPR") at p. 18, Figure 1-2.) Emissions attributable to transportation are largely a result of the majority of California's urban growth characterized by travel-inducing features: low density, unbalanced land uses separating jobs and housing, and a focus on single-occupancy vehicle travel. (California Energy Commission, The Role of Land Use In Meeting California's Energy and Climate Change Goals. (2007) at p. 9.) In approaching regulation of GHG emissions in California, for example, the California Air Resources Board ("ARB") proposes to regulate various economic sectors that are known to emit GHGs, including electric power, transportation, industrial sources, landfills, commercial and residential sectors, agriculture and forestry. (Scoping Plan, Appendix F.) With a growing population and economy, California's total GHG emissions continue to increase. As explained below, this rapid rate of increase in GHG emissions is causing a change in the composition of atmospheric gases that may cause life threatening adverse environmental consequences.

What Effects May Result from Increased Greenhouse Gas Emissions?

Several measurable effects, including, among others, an increase in global average temperatures have been attributed to increases in GHG emissions resulting from human activity. (Intergovernmental Panel on Climate Change, *Working Group 1*

[1] Multiple statewide emission inventories covering the same period of time may vary. This is largely due to inventories characterizing an emission source by sectors (e.g. agriculture, cement, transportation, etc.) which may not be treated the same depending on the methodology used and access to information. Thus, two statewide emissions inventories may be different depending on the agency that created them or its intended application. The CARB is in the process of updating its statewide data and methodologies to be consistent with international and national guidelines. The typical emissions inventory covers 1990 to 2004.

Report: The Physical Science Basis (2001), at p. 101.) Evidence further indicates that a warmer planet may in turn lead to changes in rainfall patterns, a retreat of polar icecaps, a rise in sea level, and changes in ecosystems supporting human, animal and plant life. (U.S. Environmental Protection Agency, *Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act,* April 17, 2009 ("Technical Support Document"), at pp. ES-1 to ES-3.) Climate change is not the only effect of increased GHG emissions. Impacts to human health and ocean acidification are also attributed to increasing concentrations of GHGs in the Earth's atmosphere. (*Id*. at p. 57.)

Globally elevated concentrations of GHGs have been observed to induce a range of associated effects. For example, the effects of atmospheric warming include, but are not limited to, increased likelihood of more frequent and intense natural disasters, increased drought, and harm to agriculture, wildlife, and ecological systems. (Technical Support Document at pp. ES-1, ES-6.) According to a report prepared for the California Climate Change Center:

> Climate change is likely to affect the abundance, production, distribution, and quality of ecosystem services throughout the State of California including the delivery of abundant and clean water supplies to support human consumption and wildlife, climate stabilization through carbon sequestration, the supply of fish for commercial and recreational sport fishing. For example, as described in this report, areas of the state suitable for forage production to support cattle grazing in natural areas could shift as some parts of the state become too dry to support forage and others become wetter. The ability of the State's forests to sequester carbon and support climate stabilization could be hindered as productivity decreases and fires increase. And increased water temperatures in streams due to a decrease in provision of fresh water could seriously reduce salmon reproduction and subsequently reduce the number of salmon available for commercial and recreational harvest. Also, areas of the state suitable for forage production to support cattle grazing in natural areas could shift as some parts of the state become too dry to support forage and others become wetter. All of these ecosystem services have economic value and that value and its distribution is likely to changes under a changing climate.

(Rebecca Shaw, et al., for the California Climate Change Center, *The Impact of Climate Change on California's Ecosystem Services*, March 2009, CEC-500-2009-025-D, at p. 1.)

The effects of increased GHG concentrations are already being felt in California. For example, global atmospheric changes are causing sea levels to rise. An increase of approximately 8 inches has been recorded at the Golden Gate Bridge over the past 100 years. Such sea level rise threatens low coastal areas with inundation and increased erosion. (Scoping Plan, at p. 10.)

While sea levels continue to rise, the Sierra snowpack has been shrinking. Average annual runoff from spring snowmelt has decreased 10% in the last 100 years. Because snow in the Sierra acts as a reservoir, holding winter water for use later in the year, reduced snowpack creates greater potential for summer droughts and reduced hydroelectricity generation. (Office of Environmental Health and Hazard Assessment, April, 2009, Indicators of Climate Change in California, at p. 76.) Climate change is also thought to account for changes in the timing of California's major precipitation events. As explained in a report prepared for the California Climate Change Center:

> reservoirs were designed to store only a fraction of the state's entire yearly precipitation, under the assumption that the annual mountain snowpack would melt at roughly the same time every year. During anomalously high rain or snowmelt events, reservoirs must not only store water, but also discharge excess water to avoid flooding. Water must sometimes be discharged in anticipation of large events to reduce flood risk. The dual functions of storage and flood management require reservoir managers to carefully balance factors such as precipitation, snowmelt timing, reservoir storage capacity, and demand. Even if future precipitation remains unchanged, shifts in snowmelt timing can affect California's water supply during the warm season due to reservoir storage capacity constraints.

(Sarah Kapnick and Alex Hall, for the California Climate Change Center, *Observed Changes in the Sierra Nevada Snowpack: Potential Causes and Concerns*, March 2009, CEC-500-2009-016-D, at p. 1.)

Climate change is also expected to increase the number and intensity of forest fires. (Technical Support Document, at p. 91; *see also* Indicators of Climate Change (2009) at p. 131.) A generally warmer climate is associated with a longer summer season, which in turn dries vegetation and fuels making ignition easier and hastens wildfire spread. (*Ibid*; see also A. L. Westerling, for the California Climate Change Center*, Climate Change, Growth and California Wildfire*, March 2009, CEC-500-2009-046-D, at pp. 1-2.) Not only do wildfires release additional carbon and increase air pollutants, but they also cause indirect effects. For example, wildfires reduce vegetative cover leading to increased water runoff, which has affected watersheds and dampens the effectiveness of California's water works infrastructure. This will degrade California's water quality and challenge water treatment operations to provide safe drinking water. Adverse health impacts from heat-related illnesses are expected with hotter temperatures, and, due to poorer air quality, lung disease, asthma, and other respiratory and circulatory problems will be exacerbated. (California Climate Action Team, Executive Summary Report to Governor Schwarzenegger and the California Legislature (2006) at pp. xii to xiii, 27.); see also Technical Support Document, at pp. ES-4, 69-71.)

Why is California Involved in Greenhouse Gas Regulation?

The California Legislature has determined that California is vulnerable to the effects of global warming, and, despite its global nature, action to curb GHG emissions is needed on a statewide level. The legislative findings in Assembly Bill 32 (Chapter 448, Statutes 2006) ("AB32") state:

> … Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California. The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems.
>
> … Global warming will have detrimental effects on some of California's largest industries, including agriculture, wine, tourism, skiing, recreational and commercial fishing, and forestry. It will also increase the strain on electricity supplies necessary to meet the demand for summer air-conditioning in the hottest parts of the state.

(Health & Safety Code, § 38501(a), (b).) The Legislature further declared: "action taken by California to reduce emissions of greenhouse gases will have far-reaching effects by encouraging other states, the federal government, and other countries to act." (*Id*. at subd. (d).) As the world's fifteenth largest emitter of GHGs from human activity and natural sources, California is uniquely positioned to act to reduce GHGs. (Scoping Plan, at pp. 11.)

What is California Doing to Reduce its Greenhouse Gas Emissions?

Due to its potential vulnerability to the effects of GHG emissions, and the wide variety of GHG emissions sources within its borders, California has enacted several laws and programs designed to reduce the State's GHG emissions. The primary legislative initiatives are described below.

AB32 – The Global Warming Solutions Act

Assembly Bill 32 (Chapter 448, Statutes 2006) is a key piece of California's effort to reduce its GHG emissions. AB32 requires the California Air Resources Board ("ARB") to establish regulations design to reduce California's GHG emissions to 1990 levels by 2020. (Health & Safety Code, § 38550.) On December 11, 2008, ARB adopted its Scoping Plan, detailing how California will achieve that goal through sector-by-sector regulation. (ARB, Resolution No. 08-47; see also Health & Safety Code, §

38561.) ARB must adopt, no later than January 1, 2012, rules and regulations to implement the GHG emissions reductions envisioned in the Scoping Plan. (Health & Safety Code, § 38562.)

The AB32 Scoping Plan outlines a comprehensive set of actions designed to reduce overall GHG emissions in California to 1990 levels by 2020. The Scoping Plan presents GHG emission reduction strategies and measures that combine regulatory approaches, voluntary measures, fees, policies, and programs. Reduction strategies are expected to evolve as technologies develop and progress toward the State's goal is monitored. Thus, the Scoping Plan represents California's comprehensive strategy to reduce GHG emissions on a statewide basis.

SB375

As noted above, nearly 40 percent of California's GHG emissions come from the State's transportation sector. (Chapter 728, Statutes 2007, § 1(a).) Technology innovation and lower-carbon fuels alone will not reduce transportation-related emissions sufficiently for California to reach the reduction goals set out in AB32. (*Id.* at § 1(c).) Therefore, in SB375, California enacted several measures to reduce vehicular emissions through land-use planning.

Specifically, SB375 requires ARB to develop "greenhouse gas emission reduction targets for the automobile and light truck sector" for each metropolitan planning organization (MPO). (Gov. Code, § 65080(b)(2)(A).) Once that target is set, each MPO must develop a sustainable communities strategy (SCS), as part of its regional transportation plan, that will set forth a development pattern that will achieve the reduction target approved by the ARB. (*Id.* at subd. (b)(2)(B).) The MPO's transportation planning activities must be consistent with the adopted SCS. (*Id.* at subd. (b).) While an SCS does not supersede a local government's land use authority, SB375 created an exemption from CEQA for local transit-oriented residential projects that are consistent with the applicable SCS as an incentive. (*Id.* at subd. (b)(2)(J); Pub. Resources Code, § 21155.1.)

CEQA and SB97

Many activities that will not be regulated by either AB32 or SB375 may still result in significant GHG emissions. Where those emissions may result in a significant adverse environmental impact, the California Environmental Quality Act ("CEQA") requires that a lead agency analyze those emissions, and, if those emissions are determined to be significant, to implement mitigation to reduce those emissions. Despite the enactment of AB32, however, uncertainty existed among public agencies regarding how to analyze GHG emissions in environmental documents prepared pursuant to CEQA.

Recently, environmental groups and the Attorney General have initiated several lawsuits regarding the adequacy of the GHG analysis in some environmental

documents. To provide greater certainty to lead agencies, Governor Schwarzenegger signed Senate Bill 97 (Chapter 148, Statutes 2007). (Governor Schwarzenegger's Signing Message, SB 97.) That statute, among other things, constitutes the Legislature's determination that GHG emissions and the effects of GHG emissions are appropriate subjects for CEQA analysis. Pursuant to SB97, OPR developed, and the Resources Agency will adopt, amendments to the State CEQA Guidelines to address analysis and mitigation of the potential effects of GHG emissions in CEQA documents and processes. As new information or criteria established by ARB in the AB 32 process becomes available, OPR and the Resources Agency will periodically update the CEQA Guidelines to account for that new information. This rulemaking package responds to the Legislature's directive in SB97.

BACKGROUND ON THE DEVELOPMENT OF THE PROPOSED AMENDMENTS

OPR developed the Proposed Amendments pursuant to Public Resources Code section 21083.05, which states in part:

> On or before July 1, 2009, the Office of Planning and Research shall prepare, develop, and transmit to the Resources Agency guidelines for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions as required by this division, including, but not limited to, effects associated with transportation or energy consumption.

In developing the Proposed Amendments, OPR actively sought the input, advice, and assistance of numerous interested parties and stakeholder groups. (Letter from OPR Director, Cynthia Bryant, to Secretary for the Natural Resources Agency, Mike Chrisman, April 13, 2009.) Specifically, OPR met with representatives of numerous agencies and organizations to discuss the perspectives of the business community, the environmental community, local governments, non-governmental organizations, state agencies, public health officials, CEQA practitioners and legal experts. In addition, OPR took advantage of numerous regional and statewide conferences to raise awareness about CEQA and GHG emissions among diverse audiences and to seek their input. These activities satisfy the provisions of Government Code section 11346.45 which require early public involvement in complex proposals.

After publishing a preliminary draft, on January 8, 2009, OPR continued to conduct extensive public outreach, including two public workshops, to receive input on the Preliminary Amendments. Both public workshops were well attended, drawing over two hundred participants representing various California business interests, environmental organizations, local governments, attorneys and consultants. In addition to oral comments at its workshops, OPR received over eighty written comment letters.

Some comments suggested additional amendments to the CEQA Guidelines. Other comments sought clarification of the language in the preliminary amendments. OPR incorporated those suggestions and clarifications to the extent possible and appropriate into its April 13, 2009, submittal to the Resources Agency. Some suggestions were not appropriate for inclusion, however, due to conflict with existing statutory authority and/or case law. The reasoning supporting the text of the Proposed Amendments is explained in depth in this Initial Statement of Reasons.

PROPOSED AMENDMENTS

Analysis of GHG emissions in a CEQA document presents unique challenges to lead agencies. Such analysis must be consistent with existing CEQA principles, however. Therefore, the Proposed Amendments suggest relatively modest changes to various portions of the existing CEQA Guidelines. Modifications address those issues where analysis of GHG emissions may differ in some respects from more traditional CEQA analysis. Other modifications are suggested to clarify existing law that may apply both to analysis of GHG emissions as well as more traditional CEQA analyses. The incremental approach in the Proposed Amendments is consistent with Public Resources Code section 21083(f), which directs OPR and the Resources Agency to regularly review the Guidelines and propose amendments as necessary.

The Legislature expressly left development of the Guidelines to the discretion of OPR and the Resources Agency. That discretion is governed by the Government Code, which requires that any administrative regulations be consistent, and not conflict, with existing statutory authority. (Gov. Code, § 11342.2.) Thus, the Resources Agency intends, as did OPR, the Proposed Amendments to incorporate existing law, and where necessary "to implement, interpret, make specific or otherwise carry out the provisions of the statute." (*Ibid.*) In addition, the Guidelines must be "reasonably necessary" to carry out a legislative directive. (*Ibid.*) Because the determination of "reasonable necessity" implicates an agency's expertise, courts will defer to an agency's findings of necessity unless the action is arbitrary, capricious or without reasonable basis. (*Communities for a Better Environment v. California Resources Agency* (2002) 103 Cal.App.4th 98, 109 ("*CBE*").)

The Proposed Amendments recommend changes to or additions of fourteen sections of the existing Guidelines, as well as changes to Appendices F (Energy Conservation) and G (Environmental Checklist Form). The Proposed Amendments are discussed below.

SECTION 15064. DETERMINING THE SIGNIFICANCE OF THE ENVIRONMENTAL EFFECTS CAUSED BY A PROJECT

Specific Purposes of the Amendment

Amendments are proposed to two subdivisions of the existing section 15064. The first, to subdivision (f)(5), is a grammatical correction that qualifies as a "change without regulatory effect" pursuant to section 100(a)(4) of the Office of Administrative Law's regulations governing the rulemaking process. (Cal. Code Regs., tit. 1, § 100(a)(4).) The second set of amendments is to subdivision (h)(3). The latter amendments are described in detail below.

Cumulative Impacts

Existing subdivision (h)(3) allows an agency to find that a project's potential cumulative impacts are less than significant due to compliance with requirements in a plan or mitigation program. (*CBE, supra,* 103 Cal.App.4th at 111 ("a lead agency's use of existing environmental standards in determining the significance of a project's environmental impacts is an effective means of promoting consistency in significance determinations and integrating CEQA environmental review activities with other environmental program planning and regulation").) In effect, that section creates a rebuttable presumption that compliance with certain plans and regulations reduces a project's potential incremental contribution to a cumulative effect to a level that is not cumulatively considerable.

The existing Guidelines text includes several criteria that define which plans or programs may create such a presumption. To satisfy those criteria, a plan or program must: (1) have been previously approved, (2) contain specific requirements that avoid or substantially lessen the cumulative problem within a defined geographic area, and (3) be either specified in law or approved by a public agency with jurisdiction over affected resources. These criteria ensure that the presumption applies only where plans or programs have undergone public scrutiny and include binding requirements to address a cumulative problem. The existing text lists three types of plans as examples that may be relied upon for a cumulative analysis. The word "e.g." in the existing text indicates, however, that the list is not exclusive. The Third District Court of Appeal upheld what is now section 15064(h)(3) in the *CBE* decision. (*CBE*, *supra*, 103 Cal.App.4th at 115-116.)

Use of Plans and Regulations in a Cumulative Impacts Analysis

The Proposed Amendments include two changes to subdivision (h)(3). First, the Amendments would add several plans and regulations to the list of examples. The Proposed Amendments would add "habitat conservation plan, natural community conservation plan, [and] plans or regulations for the reduction of greenhouse gas emissions" to the list of plans that may be considered in a cumulative impacts analysis.

As explained below, the Resources Agency finds that the added plans and regulations satisfy the criteria in the existing text.

"Habitat conservation plans" are defined in the federal Endangered Species Act, and typically include specific requirements to protect listed species within a defined geographic area. (16 U.S.C. § 1539.) Though a habitat conservation plan ("HCP") may be prepared to address the impacts of one particular project, HCPs may also be, and often have been, prepared to address the impacts of cumulative development within a defined area. (Fish and Wildlife Service and National Marine Fisheries Service, Habitat Conservation Planning and Incidental Take Permit Processing Handbook (November 4, 1996), at pp. 1-6 to 1-7, 1-14 to 1-15.) Most HCPs, other than "low effect HCPs," will also likely need to undergo environmental review under the National Environmental Policy Act. (*Id*. at Ch. 5.) In such cases, an applicable HCP may appropriately be used in a cumulative impacts analysis as described in subdivision (h)(3).

"Natural community conservation plans" ("NCCPs") are defined in the California Natural Community Conservation Planning Act. (Fish & G. Code, §§ 2800 et seq.) The purpose of an NCCP is to conserve natural communities at the ecosystem scale while accommodating compatible land uses. An NCCP includes, among others, measures to avoid or minimize impacts to natural communities, conservation obligations, and compliance monitoring. An NCCP is adopted by the Department of Fish and Game as well as local agencies with land use authority in a defined area. As discretionary acts of public agencies, NCCPs must undergo environmental review pursuant to CEQA. Thus, NCCPs satisfy the criteria in existing subdivision (h)(3).

The Legislature recognized local GHG planning efforts in Health & Safety Code section 38561(c) by directing the ARB to consider such programs in developing its Scoping Plan. Greenhouse gas emission reduction plans are not currently specified in law. However, the California Air Resources Board's (ARB) Climate Change Proposed Scoping Plan includes a recommended reduction target for local governments and community-level emissions of 15 percent by 2020. (California Air Resources Board, *Climate Change Proposed Scoping Plan* (2008), at p. 27 ("Scoping Plan").) The Scoping Plan also recognized the important role local greenhouse gas reduction plans would play in achieving statewide reductions. The Scoping Plan itself suggests elements that such plans should include. (Scoping Plan, Appendix C, at p. C-49.)

Independent of the Scoping Plan, many local governments have adopted, or are currently developing, various plans and programs designed to curb GHG emissions. (Office of Planning and Research, *The California Planner's Book of Lists* (January 2009) ("Book of Lists"), at pp. 92-100; see also Scoping Plan, at p. 26.) Other public agencies, such as school districts and public universities, may also adopt greenhouse gas reduction plans to govern their own activities. Provided that such plans contain specific requirements with respect to resources that are within the agency's jurisdiction to avoid or substantially lessen the agency's contributions to GHG emissions, both from its own projects and from private projects it has or will approve, such plans may be appropriately relied on in a cumulative impacts analysis. Additional guidance regarding

the characteristics of greenhouse gas reduction plans that may be used in this context is provided in the proposed Section 15183.5, and is explained in greater detail below. Thus, greenhouse gas reduction plans satisfying such criteria would satisfy the criteria in existing subdivision (h)(3).

AB 32 requires ARB to adopt regulations that achieve the maximum technologically feasible and cost effective GHG reductions to reach the adopted state-wide emissions limit. (Health & Safety Code, § 38560.) ARB has already identified several discrete early action items that will reduce GHG emissions as part of the State's effort to achieve the adopted emissions limit. Pursuant to Health and Safety Code section 38560(b), ARB will adopt regulations to make those measures enforceable by January 1, 2010. ARB's GHG reduction regulations may satisfy the criteria in existing subdivision (h)(3).

Pursuant to the proposed amendments to section 15064(h)(3), where a regulation governs a project's GHG emissions, and the project complies with that regulation, a lead agency may presume those emissions are not cumulatively considerable. That presumption is rebuttable, however. The Proposed Amendments do not alter the standard, reflected in the existing Guidelines, that if substantial evidence supports a fair argument that, despite compliance with the requirements in a plan or program, a project may have a significant effect on the environment, then an EIR must be prepared.

<u>Demonstrating How the Plan Addresses Cumulative Impacts</u>

In addition to augmenting the list of plans and regulations that give rise to the presumption that a project's contribution is not cumulatively considerable, the Proposed Amendments also contain explanatory language designed to ensure that the plan or regulation relied on in a cumulative impacts analysis actually addresses the cumulative effect of concern. This language is necessary to avoid misapplication of subdivision (h)(3). For example, shortly after ARB identified early action items, some lead agencies determined that a project's contribution of GHG emissions was not cumulatively considerable because the project was not inconsistent with the early action items. (See, e.g., Tentative Ruling, San Bernardino County Superior Court Case Nos. 810232, 800607 (ruling that consistency with CAT Strategies alone does not provide sufficient information about the potential impacts of a project); see also California Environmental Protection Agency, *Climate Action Team Report to Governor Schwarzenegger and the Legislature*, March 2006, at pp. 39-63.) Such an analysis, however, would fail to account for emissions that are not addressed by the early action items. Because those early action items largely addressed industrial-type emissions, consistency with the early action items would have little relevance for a residential subdivision project. Likewise, consistency with plans that are purely aspirational (i.e., those that include only unenforceable goals without mandatory reduction measures), and provide no assurance that emissions within the area governed by the plan will actually address the cumulative problem, may not achieve the level of protection necessary to give rise to this subdivision's presumption. Thus, by requiring that lead agencies draw a link between

the project and the specific provisions of a binding plan or regulation, section 15064(h)(3) would ensure that cumulative effects of the project are actually addressed by the plan or regulation in question.

Demonstrating that compliance with a plan addresses a cumulative problem is already impliedly required by CEQA. For example, an initial study must include sufficient information to support its conclusions. (State CEQA Guidelines, § 15063(d)(3).) Similarly, section 15128 requires a lead agency to explain briefly the reasons that an impact is determined to be less than significant and therefore was not analyzed in an EIR. The added sentence, therefore, reflects existing law and is necessary to ensure that plans are not misapplied in a CEQA analysis.

Policy Goals

Inclusion of additional plans and programs to the list of examples supports two policy goals. First, an expanded list promotes integration of various regulatory mechanisms to reduce duplication. (See, e.g., Pub. Resources Code, § 21003(a) (state policy is that "[l]ocal agencies integrate the requirements of [CEQA] with planning and environmental review procedures otherwise required by law or by local practice …"), (f) ("[a]ll persons and public agencies involved in the environmental review process be responsible for carrying out the process in the most efficient, expeditious manner in order to conserve the available financial, governmental, physical, and social resources with the objective that those resources may be better applied toward the mitigation of actual significant effects on the environment").) Second, the addition of GHG emissions reduction plans and regulations for the reduction of GHG emissions reflects the view of both the OPR and the Resources Agency that the effects of GHG emissions resulting from individual projects are best addressed and mitigated at a programmatic level.

Necessity

The Legislature directed OPR and the Resources Agency to develop guidelines on the analysis of GHG emissions. (Pub. Resources Code, § 21083.05.) The Guidelines must address the determination of whether the "possible effects of a project are individually limited but cumulatively considerable." (*Id*. at § 21083(b)(2).) Due to the global nature of GHG emissions and their potential effects, GHG emissions will typically be addressed in a cumulative impacts analysis. (See, e.g., EPA, Draft Endangerment Finding, 74 Fed. Reg. 18886, 18904 (April 24, 2009) ("cumulative emissions are responsible for the cumulative change in the stock of concentrations in the atmosphere"); California Air Pollution Control Officers Association, *CEQA and Climate Change: Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act* (January 2008) ("CAPCOA White Paper"), at p. 35 ("GHG impacts are exclusively cumulative impacts; there are no non-cumulative GHG emission impacts from a climate change perspective").) Existing section 15064(h) governs the analysis of cumulative effects in an initial study. The proposed amendments to section 15064(h)(3), on determining the significance of

cumulative impacts in an initial study, are therefore necessary to carry out this legislative directive.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and that the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific statutory CEQA provisions and case law interpreting CEQA for determining the significance of GHG emissions that may result from proposed projects. Many lead agencies, and some trial courts, have already determined that CEQA requires analysis and mitigation of GHG emissions independent of the SB97 CEQA Guidelines amendments. The Office of Planning and Research, for example, has cataloged over 1,000 examples of CEQA documents, prepared between July 2006 and June 2009, analyzing and mitigating GHG emissions. (Office of Planning and Research, Environmental Assessment Documents Containing a Discussion of Climate Change (Revised June 1, 2009).) Further, several trial courts have found that existing CEQA law requires analysis and mitigation of GHG emissions. (See, e.g., *Muriettans for Smart Growth v. City of Murrieta et al.*, Riverside Co. Sup. Ct. Case No. RIC463320 (November 21, 2007); *Env. Council of Sac. et al v. Cal. Dept. of Trans.*, Sacramento Sup. Ct. Case No. 07CS00967 (July 15, 2008) (citing *Berkeley Keep Jets Over the Bay Committee v. Board of Commissions* (2001) 91 Cal.App. 4th 1344, 1370-1371 and State CEQA Guidelines section 15144 as requiring a lead agency to "meaningfully attempt to quantify the Project's potential impacts on GHG emissions and determine their significance" or at least to explain what steps were undertaken to investigate the issue before concluding that the impact would be speculative).) Finally, federal courts have interpreted the National Environmental Policy Act ("NEPA") to require an analysis of potential impacts of GHG emissions. (*See*, *e.g.*, *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Ad.*, 538 F.3d 1172, 1215-1217 (9th Cir. 2008).)[2] Thus, the amendments to the CEQA Guidelines developed pursuant to

[2] Federal court decisions interpreting NEPA is persuasive authority in CEQA cases. (*Western Placer Citizens for an Ag. & Rur. Env. v. County of Placer* (2006) 144 Cal.App. 4th 890, 902.)

SB97 do not create new requirements; rather, they interpret and clarify existing CEQA law.

Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California. On the contrary, the proposed amendments to this section are intended to reduce the costs of environmental review on lead agencies and project applicants by encouraging the use of existing environmental analysis where available. (Pub. Resources Code, § 21003(d) (use information in existing EIRs in order to reduce duplication), (f) (environmental review should proceed in the most efficient manner possible).)

SECTION 15064.4. DETERMINING THE SIGNIFICANCE OF IMPACTS FROM GREENHOUSE GAS EMISSIONS

Specific Purposes of the Amendment

A key component of environmental analysis under CEQA is the determination of significance. (Pub. Resources Code § 21002; *Protect the Historic Amador Waterways v. Amador Water Agency* (2004) 116 Cal.App.4th 1099, 1106-07.) Guidelines on the analysis of GHG emissions must, therefore, include provisions on the determination of significance of those emissions.

The proposed section 15064.4, on the determination of significance of GHG emissions, reflects the existing CEQA principle that there is no iron-clad definition of "significance." (State CEQA Guidelines, § 15064(b); *Berkeley Keep Jets Over the Bay Com. v. Board of Port Comm*. (2001) 91 Cal.App.4th 1344, 1380-81 ("*Berkeley Jets*").) Accordingly, lead agencies must use their best efforts to investigate and disclose all that they reasonably can regarding a project's potential adverse impacts. (*Ibid*; *see also* State CEQA Guidelines, § 15144.) Section 15064.4 is designed to assist lead agencies in performing that required investigation. In particular, it provides that lead agencies should quantify GHG emissions where quantification is possible and will assist in the determination of significance. In addition, lead agencies should also consider qualitative factors where relevant. The specific provisions of section 15064.4 are discussed below.

Quantify Emissions Where Possible

Subdivision (a) of section 15064.4 states that lead agencies should calculate or estimate the GHG emissions resulting from the proposed project. This directive reflects the holding in *Berkeley Jets* case, which required a Port Commission to quantify emissions of toxic air contaminants even in the absence of a universally accepted methodology for doing so. (*Berkeley Jets*, *supra*, 91 Cal.App.4th at p. 1370 ("The fact that a single methodology does not currently exist that would provide the Port with a precise, or 'universally accepted,' quantification of the human health risk from TAC exposure does not excuse the preparation of any health risk assessment--it requires the Port to do the necessary work to educate itself about the different methodologies that are available") (emphasis in original).) That case also required quantitative analysis of single-event noise, even though the applicable thresholds were expressed as cumulative noise levels. (*Id*. at 1382.) Quantification was required in that context in order to identify existing noise levels, the number of additional flights, the frequency of those flights, the degree to which the increased flights would cause increased noise levels at a given location, and ultimately, the community's reaction to that noise. (*Ibid*.) In other words, quantification would assist the lead agency in determining whether the increased noise would be potentially significant. (*Ibid*. ("CEQA requires that the Port and the inquiring public obtain the technical information needed to assess whether the ADP will merely inconvenience the Airport's nearby residents or damn them to a somnambulate-like existence"); see also *Protect the Historic Amador Waterways*, *supra*,

116 Cal.App.4th at 1109 ("in preparing an EIR, the agency must consider and resolve every fair argument that can be made about the possible significant environmental effects of a project, irrespective of whether an established threshold of significance has been met with respect to any given effect").)

With the foregoing principles in mind, the quantification called for in proposed section 15064.4(a)(1) is reasonably necessary to ensure an adequate analysis of GHG emissions using available data and tools, in accordance with Public Resources Code Section 21083.05. Even where a lead agency finds that no numeric threshold of significance applies to a proposed project, the holdings in the *Berkeley Jets* and *Protect the Historic Amador Waterways* cases, described above, require quantification of emissions if such quantification will assist in determining the significance of those emissions. OPR and the Resources Agency find that quantification will, in many cases, assist in the determination of significance, as explained below. (State CEQA Guidelines, § 15142 ("An EIR shall be prepared using an interdisciplinary approach which will ensure the integrated use of the natural and social sciences and the consideration of qualitative as well as quantitative factors").)

First, quantification of GHG emissions is possible for a wide range of projects using currently available tools. Modeling capabilities have improved to allow quantification of emissions from various sources and at various geographic scales. (Office of Planning and Research, *CEQA and Climate Change: Addressing Climate Change Through the California Environmental Quality Act Review*, Attachment 2: Technical Resources/Modeling Tools to Estimate GHG Emissions (June 2008); CAPCOA White Paper, at pp. 59-78.) Moreover, one of the models that can be used in a GHG analysis, URBEMIS, is already widely used in CEQA air quality analyses. (CAPCOA White Paper, at p. 59.) Second, quantification informs the qualitative factors listed in proposed section 15064.4(b). Third, quantification indicates to the lead agency, and the public, whether emissions reductions are possible, and if so, from which sources. Thus, if quantification reveals that a substantial portion of a project's emissions result from energy use, a lead agency may consider whether design changes could reduce the project's energy demand.

Proposed section 15064.4(a)(1) also reflects existing case law that reserves for lead agencies the precise methodology to be used in a CEQA analysis. (*See*, *e.g.*, *Eureka Citizens for Responsible Gov't v. City of Eureka* (2007) 147 Cal.App.4th 357, 371-373.) As indicated above, a wide variety of models exist that could be used in a GHG analysis. (CAPCOA White Paper, at pp. 59-78.) Further, not every model will be appropriate for every project. For example, URBEMIS may be an appropriate tool to analyze a typical residential subdivision or commercial use project, but some public utilities projects, such as waste-water treatment plants, may require more specialized models to accurately estimate emissions. (*Id.* at pp. 60-65.) The requirement to disclose any limitations in the model or methodology chosen also reflects the standard for adequacy of EIRs in existing State CEQA Guidelines section 15151.

Qualitative and Performance Standard Based Analysis

If the lead agency determines that quantification is not possible, or would not yield information that would assist in analyzing the project's impacts and determining the significance of the GHG emissions, proposed section 15064.4(a) would allow the lead agency to consider qualitative factors or performance standards. Consideration of qualitative factors is appropriate for several reasons. First, CEQA directs lead agencies to consider qualitative factors. (Pub. Resources Code, § 21001(f) (CEQA's purpose includes to: "require governmental agencies at all levels to consider qualitative factors as well as economic and technical factors and long-term benefits and costs, in addition to short-term benefits and costs and to consider alternatives to proposed actions affecting the environment").) Second, existing section 15064.7 of the State CEQA Guidelines indicate that thresholds of significance may be qualitative, which implies that a determination of significance without a threshold could also evaluate qualitative factors. Third, the existing CEQA Guidelines state that the determination of significance requires a lead agency to use its judgment based on *all* relevant information. (State CEQA Guidelines, § 15064(b); see also id. at §§ 15064.7 (thresholds may be qualitative), 15142 (analysis should be interdisciplinary and both qualitative and quantitative).)

Subdivision (a) would also allow a lead agency to rely on performance-based standards to assist in the determination of significance. Just as with quantification, the purpose of engaging in a qualitative or performance standard based analysis is to develop information relevant to a significance determination. Similar to use of a significance threshold, a lead agency must exercise care to ensure that performance standards do not replace a full analysis of all potential emissions. (*Protect the Historic Amador Waterways*, *supra*, 116 Cal.App.4th at 1109 ("in preparing an EIR, the agency must consider and resolve every fair argument that can be made about the possible significant environmental effects of a project, irrespective of whether an established threshold of significance has been met with respect to any given effect").) For example, while a Platinum LEED® rating could assist a lead agency in determining whether emissions related to a building's energy use may be significant, that performance standard may not reveal sufficient information to evaluate transportation-related emissions associated with that proposed project.

Qualitative Factors

The qualitative factors listed in the proposed section 15064.4(b) are intended to assist lead agencies in collecting and considering information relevant to a project's incremental contribution of GHG emissions and the overall context of such emissions. Notably, while subdivision (b) provides a list of factors that may assist public agencies to consider all relevant information, other factors can and should be considered as appropriate.

Determine Whether Emissions Will Increase or Decrease

The first factor in subdivision (b), for example, asks lead agencies to consider whether the project will result in an increase or decrease in different types of GHG emissions relative to the existing environmental setting. All project components, including construction and operation, equipment and energy use, and development phases must be considered in this analysis. (State CEQA Guidelines, § 15378 (project includes "the whole of the action").) For example, a mass transit project may involve GHG emissions during its construction phase, but substantial evidence may also indicate that it will cause existing commuters to switch from single-occupant vehicles to mass transit use. Operation of such a project may ultimately result in a decrease in GHG emissions. Such analysis may support a lead agency's determination that GHG emissions associated with a project are not cumulatively considerable.

This section's reference to the "existing environmental setting" reflects existing law requiring that impacts be compared to the environment as it currently exists. (State CEQA Guidelines, § 15125.) This clarification is necessary to avoid a comparison of the project against a "business as usual" scenario as defined by ARB in the Scoping Plan. Such an approach would confuse "business as usual" projections used in ARB's Scoping Plan with CEQA's separate requirement of analyzing project effects in comparison to the environmental baseline. (*Compare* Scoping Plan, at p. 9 ("The foundation of the Proposed Scoping Plan's strategy is a set of measures that will cut greenhouse gas emissions by nearly 30 percent by the year 2020 as compared to business as usual") *with Fat v. County of Sacramento* (2002) 97 Cal.App.4th 1270, 1278 (existing environmental conditions normally constitute the baseline for environmental analysis); see also *Center for Bio. Diversity v. City of Desert Hot Springs*, Riverside Sup. Ct. Case No. RIC464585 (August 6, 2008) (rejecting argument that a large subdivision project would have a "beneficial impact on CO2 emissions" because the homes would be more energy efficient and located near relatively uncongested freeways).) Business as usual may be relevant, however, in the discussion of the "no project alternative" in an EIR. (State CEQA Guidelines, § 15126.6(e)(2) (no project alternative should describe what would reasonably be expected to occur in the future in the absence of the project).)

Notably, the proposed section 15064.4(b)(1) is not intended to imply a zero net emissions threshold of significance. As explained in greater detail in the discussion of cumulative impacts below, there is no "one molecule rule" in CEQA. (CBE, *supra*, 103 Cal.App.4th at 120.)

Thresholds of Significance

The second factor in subdivision (b) asks whether a project exceeds a threshold of significance for GHG emissions. Section 21000(d) of the Public Resources Code expressly directs public agencies to identify whether there are any critical thresholds for health and safety to identify those areas where the capacity of the environment is limited. A threshold is a numeric or qualitative level at which impacts are normally less

than significant. (State CEQA Guidelines, § 15064.7(a); *see also Protect the Historic Amador Waterways*, *supra*, 116 Cal.App.4th at 1107.) Lead agencies may rely on thresholds developed by other agencies that have particular expertise in the subject matter under consideration. (*See*, *e.g.*, State CEQA Guidelines, Appendix G, Sample Question III ("[w]here available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make" a significance determination).) For example, a lead agency may look to standards included in a Basin Plan to assist in the determination of whether water quality impacts are significant. (*Protect the Historic Amador Waterways*, *supra*, 116 Cal.App.4th at 1107 ("[s]uch thresholds can be drawn from existing environmental standards, such as other statutes or regulations").)

Several agencies have developed, or are in the process of developing, thresholds of significance for GHG emissions. For example, thresholds are currently being developed, or have already been adopted by the Bay Area Air Quality Management District for operations and construction,[3] the City of Davis for residential developments,[4] and the South Coast Air Quality Management District for industrial projects.[5] Regardless of the threshold chosen, however, this section does not alter the pre-existing rule under CEQA that if substantial evidence supports a fair argument that a project may result in significant impacts, despite compliance with a threshold, an EIR must be prepared. (*Mejia v. City of Los Angeles* (2005) 130 Cal.App.4th 322, 342.) Further, "in preparing an EIR, the agency must consider and resolve every fair argument that can be made about the possible significant environmental effects of a project, irrespective of whether an established threshold of significance has been met with respect to any given effect." (*Protect the Historic Amador Waterways*, *supra*, 116 Cal.App.4th at 1109.)

Consistent with the above, lead agencies must exercise caution in selecting a threshold to ensure that the threshold is appropriately applied. For CEQA purposes, a threshold identifies a level below which an environmental impact will normally be less than significant. (State CEQA Guidelines, § 15064.7(a).) ARB has adopted several thresholds pursuant to AB32, for example, to address specific purposes that are unrelated to CEQA. For example, the *de minimis* threshold governs the level at which emissions will be regulated by ARB's AB32 regulations. (Health & Safety Code, § 38561(e); Scoping Plan, at pp. 96-97.) CEQA does not permit use of a *de minimis* threshold, however. (*CBE*, *supra*, 103 Cal.App.4th at p. 121.) Additionally, the Reporting Threshold is the level at which emissions from large industrial sources are required to be reported. (Scoping Plan, at pp. 108-109; *see also* CARB Board Resolution 07-54 (2007).) Again, this reporting threshold reflects a policy decision regarding regulation by the ARB, but does not address the level at which environmental

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[3] BAAQMD CEQA Guidelines Update: work in progress - http://www.baaqmd.gov/pln/ ceqa/index.htm.

[4] City of Davis (2009) Greenhouse Gas Emission Threshold and Standards for New Residential Development; Accessed 5/27/09, http://cityofdavis.org/pgs/sustainability/pdfs/ 15_4.21.09_GHG%20Standards.pdf

[5] SCAQMD (2008) Interim CEQA GHG Significance Threshold for Stationary Sources, Rules and Plans, Accessed 5/27/09 http://www.aqmd.gov/hb/2008/December/081231a.htm.

harm may occur, and does not satisfy a lead agency's duties under CEQA related to review of projects which may result in significant adverse environmental impacts.

Consistency with a Plan or Regulation

Finally, the third factor in subdivision (b) suggests consideration of the extent to which a project complies with a plan or regulation to reduce GHG emissions. That section further states, however, that to be used for the purpose of determining significance, a plan must contain specific requirements that result in reductions of GHG emissions to a less than significant level. This clarification is necessary because of the wide variety of climate action plans and GHG reduction plans that are currently being adopted by public agencies. ARB, for example, recently adopted its statewide Scoping Plan. That plan may not be appropriate for use in determining the significance of individual projects, however, because it is conceptual at this stage and relies on the future development of regulations to implement the strategies identified in the Scoping Plan. (Scoping Plan, at p. 9.) Regulations that will require actual reductions of GHG emissions may not be adopted until 2012. (*Ibid*.) Once those regulations are adopted and being implemented, they may, where appropriate, be used to assist in the determination of significance, similar to the current use of air quality, water quality and other similar environmental regulations. (*CBE*, *supra*, 103 Cal. App. 4th at 111 ("a lead agency's use of existing environmental standards in determining the significance of a project's environmental impacts is an effective means of promoting consistency in significance determinations and integrating CEQA environmental review activities with other environmental program planning and regulation").)

In addition to the regulations that will be developed to implement the Scoping Plan, this factor would also allow lead agencies to consider plans that are developed to reduce GHG emissions on a regional or local level. (Scoping Plan, at p. 26.) The proposed section 15064.4(b)(3) is intended to be read in conjunction with the section 15064(h)(3), as proposed to be amended, and proposed section 15183.5. Those sections each indicate that local and regional plans may be developed to reduce GHG emissions. If such plans reduce community-wide emissions to a level that is less than significant, a later project that complies with the requirements in such a plan may be found to have a less than significant impact.

Notably, CEQA does not provide a specific definition of "comply" in the context of determining a project's consistency with a particular plan. Some guidance may be gleaned, however, from case law interpreting the requirement that a local government's activities be consistent with its General Plan. In that context, a "zoning ordinance [for example] is consistent with the city's general plan where, considering all of its aspects, the ordinance furthers the objectives and policies of the general plan and does not obstruct their attainment." (*City of Irvine v. Irvine Citizens Against Overdevelopment* (1994) 25 Cal. App. 4th 868, 879.) Reading section 15064.4 together with 15064(h)(3), however, to demonstrate consistency with an existing GHG reduction plan, a lead agency would have to show that the plan actually addresses the emissions that would result from the project. Thus, for example, a subdivision project could not demonstrate

"consistency" with the ARB's Early Action Measures because those measures do not address emissions resulting from a typical housing subdivision. (ARB, Expanded List of Early Action Measures to Reduce Greenhouse Gas Emissions in California Recommended for Board Consideration, October 2007; see also State CEQA Guidelines, §§ 15063(d)(3) (initial study must be supported with information to support conclusions), 15128 (determination in an EIR that an impact is less than significant must be briefly explained).)

Necessity

The Legislature directed OPR and the Resources Agency to develop guidelines on the analysis of GHG emissions. (Pub. Resources Code, § 21083.05.) A key component of environmental analysis under CEQA is the determination of significance. (*Id*. at § 21002; *Protect the Historic Amador Waterways, supra,* 116 Cal.App.4th at 1106-07.) The proposed new section 15064.4, on determining the significance of impacts of GHG emissions, is therefore necessary to carry out this legislative directive.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific statutory CEQA provisions and/or case law interpreting CEQA for determining the significance of GHG emissions that may result from proposed projects. Many lead agencies, and some trial courts, have already determined that CEQA requires analysis and mitigation of GHG emissions independent of the SB97 CEQA Guidelines amendments. The Office of Planning and Research, for example, has cataloged over 1,000 examples of CEQA documents, prepared between July 2006 and June 2009, analyzing and mitigating GHG emissions. (Office of Planning and Research, Environmental Assessment Documents Containing a Discussion of Climate Change (Revised June 1, 2009).) Further, several trial courts have found that existing CEQA law requires analysis and mitigation of GHG emissions. (See, e.g., *Muriettans for Smart Growth v. City of Murrieta et al*., Riverside Co. Sup. Ct. Case No. RIC463320 (November 21, 2007); *Env. Council of Sac. et al v. Cal. Dept. of Trans*., Sacramento Sup. Ct. Case No. 07CS00967 (July 15, 2008) (citing *Berkeley Keep Jets Over the Bay Committee v. Board of Commissions* (2001) 91 Cal.App. 4th 1344, 1370-1371 and State CEQA Guidelines section 15144 as requiring a lead agency to "meaningfully attempt to quantify the Project's potential impacts on GHG emissions and determine their significance" or at least to explain what steps were undertaken to investigate the issue before concluding that the impact would be speculative).) Finally, federal courts have interpreted the National Environmental Policy Act ("NEPA") to require an analysis of potential impacts of GHG emissions. (*See*, *e.g*., *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Ad*., 538 F.3d 1172, 1215-1217 (9th Cir. 2008).)[6] Thus, the amendments to the CEQA Guidelines developed pursuant to SB97 do not create new requirements; rather, they interpret and clarify existing CEQA law.

Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California. On the contrary, by providing greater certainty to lead agencies regarding the determination of significance of GHG emissions, the cost of environmental analysis, and potential litigation, may be reduced.

[6] Federal court decisions interpreting NEPA is persuasive authority in CEQA cases. (*Western Placer Citizens for an Ag. & Rur. Env. v. County of Placer* (2006) 144 Cal.App. 4th 890, 902.)

SECTION 15064.7. THRESHOLDS OF SIGNIFICANCE

Specific Purposes of the Amendment

Proposed subdivision (c) of section 15064.7 would allow a lead agency to adopt a threshold developed by another agency, or recommended by experts, provided that such threshold is supported with substantial evidence. This proposed regulation is reasonably necessary because many lead agencies perform general governmental functions, and may lack the specific expertise necessary to develop their own thresholds of significance for GHG emissions. Such agencies may rely on thresholds developed by other agencies with specialized expertise (such as an air quality management district) in conducting their CEQA analyses. (OPR, Thresholds of Significance: Criteria for Defining Environmental Significance, September 1994, at p. 7.) In fact, Appendix G of the State CEQA Guidelines expressly encourages lead agencies to rely on thresholds established by local air quality management districts. (State CEQA Guidelines, Appendix G, Question III.)

Several local and regional air districts are in the process of developing thresholds for GHG emissions. As noted above, for example, thresholds are currently being developed, or have already been adopted by the Bay Area Air Quality Management District for operations and construction, the City of Davis for residential developments, and the South Coast Air Quality Management District for industrial projects.[7] Lead agencies within the jurisdiction of an air district, or other agency, that adopts a GHG emissions threshold may adopt such a threshold as its own. In adopting any threshold of significance, including one developed by an expert or agency with specialized expertise, the lead agency must support the threshold with substantial evidence in the administrative record. (State CEQA Guidelines, § 15064.7(b).)

Independent experts may also develop such thresholds for use by public agencies. For example, the California Air Pollution Control Officers Association has published a White Paper on developing thresholds of significance for GHG emissions. (CAPCOA White Paper, at pp. 31-58.) A lead agency could potentially use CAPCOA's suggestions in developing its own thresholds. Because any threshold must be supported with substantial evidence, and must be adopted through a public process, any threshold recommended by an expert that is ultimately adopted will undergo sufficient scrutiny to ensure its legitimacy. (State CEQA Guidelines, § 15064.7(b).)

Necessity

The Legislature directed OPR and the Resources Agency to develop guidelines on the analysis of GHG emissions. (Pub. Resources Code, § 21083.05.) Defining "significance" is a critical step in the lead agency's impact analysis and therefore needs to be addressed as part of the Proposed Action. Section 21000(d) of the Public

[7] Reference to these thresholds and proposed thresholds does not reflect an endorsement of those thresholds; rather, they are cited solely for the purpose of demonstrating that agencies are developing such thresholds.

Resources Code encourages the development of thresholds. These sections together require OPR and the Resources Agency to develop and adopt regulations governing the adoption of thresholds of significance for GHG emissions.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific statutory CEQA provisions and/or case law interpreting CEQA for determining the significance of GHG emissions that may result from proposed projects. Many lead agencies, and some trial courts, have already determined that CEQA requires analysis and mitigation of GHG emissions independent of the SB97 CEQA Guidelines amendments. The Office of Planning and Research, for example, has cataloged over 1,000 examples of CEQA documents, prepared between July 2006 and June 2009, analyzing and mitigating GHG emissions. (Office of Planning and Research, Environmental Assessment Documents Containing a Discussion of Climate Change (Revised June 1, 2009).) Further, several trial courts have found that existing CEQA law requires analysis and mitigation of GHG emissions. (See, e.g., *Muriettans for Smart Growth v. City of Murrieta et al.*, Riverside Co. Sup. Ct. Case No. RIC463320 (November 21, 2007); *Env. Council of Sac. et al v. Cal. Dept. of Trans.*, Sacramento Sup. Ct. Case No. 07CS00967 (July 15, 2008) (citing *Berkeley Keep Jets Over the Bay Committee v. Board of Commissions* (2001) 91 Cal.App. 4th 1344, 1370-1371 and State CEQA Guidelines section 15144 as requiring a lead agency to "meaningfully attempt to quantify the Project's potential impacts on GHG emissions and determine their significance" or at least to explain what steps were undertaken to investigate the issue before concluding that the impact would be speculative).) Finally, federal courts have interpreted the National Environmental Policy Act ("NEPA") to require an analysis of potential impacts of GHG emissions. (*See*, *e.g.*, *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Ad.*, 538 F.3d 1172, 1215-1217 (9th Cir. 2008).) Thus, the amendments to the CEQA Guidelines developed pursuant to

SB97 do not create new requirements; rather, they interpret and clarify existing CEQA law.

Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California. On the contrary, by providing greater certainty to lead agencies regarding the determination of significance of GHG emissions, the cost of environmental analysis, and potential litigation, may be reduced.

SECTION 15065. MANDATORY FINDINGS OF SIGNIFICANCE

Specific Purposes of the Amendment

The proposed amendment to section 15065(b)(1) would change the word "preliminary" to "public." The purpose of this amendment is to make section 15065 consistent with section 21064.5 of the Public Resources Code. The latter provision defines a mitigated negative declaration to be a negative declaration where mitigation measures are added to a project "before the proposed negative declaration and initial study are released for *public* review[.]" (State CEQA Guidelines, § 15070(b)(1).) In contrast, existing CEQA Guidelines section 15065(b)(1), dealing with mandatory findings of significance, would require a commitment to mitigation prior to "preliminary" review. "Preliminary Review," as that term is used in section 15060, refers to a period following receipt of an application during which a lead agency determines whether an exemption applies to the project or whether an EIR would clearly be prepared. Read literally, existing section 15065 would require a commitment to mitigation before an initial study is even conducted. Because the statutory definition of mitigated negative declaration contemplates that mitigation measures may be developed during the preparation of the initial study prior to public review, the proposed change in 15065 from "preliminary" to "public" is appropriate.

Necessity

Section 21083 of the Public Resources Code directs OPR to develop, and the Resources Agency to adopt, guidelines on the implementation of CEQA. The proposed change is necessary to ensure that those guidelines are consistent with relevant statutory definitions.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action would make the existing Guidelines easier to follow as a result of greater internal consistency. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revision. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific existing statutory CEQA provisions and/or case law interpreting CEQA. Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California. On the contrary, by providing greater consistency within the Guidelines, the cost of environmental analysis, and potential litigation, may be reduced.

SECTION 15086. CONSULTATION CONCERNING DRAFT EIR

The proposed revision to this section is a non-substantive correction to this section's reference to the California Air Resources Board. This revision, therefore, qualifies as a "change without regulatory effect" pursuant to section 100(a)(4) of the Office of Administrative Law's regulations governing the rulemaking process. (Cal. Code Regs., tit. 1, § 100(a)(4).)

SECTION 15093. STATEMENT OF OVERRIDING CONSIDERATIONS

Specific Purposes of the Amendment

Section 21081(b) of the Public Resources Code provides that a lead agency may adopt a project with significant and unavoidable impacts only after the lead agency makes a finding that "specific overriding economic, legal, social, technical or other benefits of the project outweigh the significant effects on the environment." The State CEQA Guidelines describes the factors that a lead agency must weigh in determining whether to approve a project with adverse environmental effects:

> CEQA recognizes that in determining whether and how a project should be approved, a public agency has an obligation to balance a variety of public objectives, including economic, environmental, and social factors and in particular the goal of providing a decent home and satisfying living environment for every Californian. An agency shall prepare a statement of overriding considerations as described in Section 15093 to reflect the ultimate balancing of competing public objectives when the agency decides to approve a project that will cause one or more significant effects on the environment.

(State CEQA Guidelines, § 15021(d).) The California Supreme Court has further observed that "an agency's decision that the specific benefits a project offers outweigh any environmental effects that cannot feasibly be mitigated … lies at the core of the lead agency's discretionary responsibility under CEQA…." (*City of Marina v. Board of Trustees of Cal. State Univ* (2006) 39 Cal.4th 341, 368.)

In the context of GHG emissions, some projects may cause adverse environmental impacts but still provide an overall benefit of reducing GHG emissions on a statewide or regional level. For example, a city may make a policy choice to allow increased housing density within a jobs-rich region in order to reduce region-wide GHG emissions from vehicles and transportation. (See, e.g., 2007 IEPR, at p. 210.) Though the introduction of new housing within the jurisdiction may result in near-term or local adverse impacts related to GHG emissions, doing so may assist the region as a whole in meeting region-wide reduction targets. Thus, a new subdivision (d) is proposed to be added to section 15093 that would expressly allow a lead agency to consider this type of environmental benefit of a project in making a statement of overriding considerations.

The proposed addition to section 15093 accomplishes two objectives. First, it reminds lead agencies and the public that even a project that appears environmentally beneficial may itself cause adverse environmental impacts, and such impacts must undergo full CEQA review, and, if applicable, a statement of overriding considerations. Second, it discourages purely local interests from dominating consideration of a project by expressly allowing a lead agency to consider region- and statewide benefits of a project. Further, "economic, legal, social, technical and other benefits" could be interpreted to refer to local benefits. This addition would ensure that lead agencies may

consider regional and statewide benefits in considering a project's adverse impacts. Finally, the proposed addition makes clear, consistent with section 15021(d) of the existing State CEQA Guidelines, that the lead agency may consider environmental benefits to balance a project's significant adverse environmental effects that remain even after the adoption of all available feasible mitigation measures.

Necessity

The Legislature directed OPR and the Resources Agency to develop guidelines on the analysis of GHG emissions. (Pub. Resources Code, § 21083.05.) If a lead agency determines that a project's GHG emissions will result in significant and unavoidable impacts, a lead agency may only approve the project if it makes specified findings. (*Id*. at § 21081(b).) This amendment is necessary to ensure that a lead agency considers state-wide and regional benefits of a project in addition to purely local benefits. Because consideration of state-wide and region-wide benefits may also apply to impacts unrelated to GHG emissions, the amendment was worded broadly to address any significant environmental impact.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and/or makes specific statutory CEQA provisions and case law interpreting CEQA for making statements of overriding considerations. Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California.

SECTION 15125. ENVIRONMENTAL SETTING

Specific Purposes of the Amendment

Section 15125 reflects existing law requiring examination of project impacts in relation to the existing environment. Subsection (d) states that lead agencies should consider whether the proposed project is inconsistent with applicable local and regional plans. That subsection provides a non-exclusive list of plans for potential consideration. The Proposed Amendments would add specific plans, regional blueprint plans and greenhouse gas reduction plans to subdivision (d). The added plans are necessary to ensure that GHG emissions analyses in such plans are addressed.

Specific Plans

Specific Plans address a defined geographic area within the area covered by a General Plan. (Gov. Code, § 65450 ("After the legislative body has adopted a general plan, the planning agency may, or if so directed by the legislative body, shall, prepare specific plans for the systematic implementation of the general plan for all or part of the area covered by the general plan").) Specific Plans must contain "[s]tandards and criteria by which development will proceed, and standards for the conservation, development, and utilization of natural resources, where applicable." (*Id*. at § 65451(a)(3).) Thus, given that so many local governments are addressing GHG emissions in their policy documents, and that Specific Plans must contain standards and criteria, it is likely that Specific Plans may address GHG emissions, and consistency with adopted Specific Plans should be considered in EIRs.

Regional Blueprint Plans

Regional Blueprint Plans are being developed in many of California's Metropolitan Planning Organizations through grants provided by the California Department of Transportation. While originally designed to address transportation efficiencies, Regional Blueprint Plans typically involve smart growth planning with an aim to reducing vehicle miles traveled at a regional level. As a result, Regional Blueprint Plans can provide information regarding the region's existing transportation setting and identify methods to reduce region-wide transportation-related impacts. (Scoping Plan, Appendix C, at pp. C-74-C-84.) Land use decisions impact many sectors responsible for GHG emissions, including transportation, electricity, water, waste, and others. However, the primary impact of land use development on GHG emissions relates to vehicle use. (Land Use Subcommittee of the Climate Action Team, *LUSCAT Submission to CARB Scoping Plan on Local Government, Land Use, and Transportation* (2008), at p. 13.) Blueprint Plans highlight this relationship between land use and transportation and how this relationship may impact a local community's and region's GHG emissions. Analysis of GHG reduction is not required by Blueprint grants but it is recommended. Therefore, Blueprint Plans provide an indication of the GHG emissions potentially created or reduced by the plan. (LUSCAT (2009), at p. 30.) Given the large percentage of GHG emissions that result from transportation in

California, a project's consistency with a Regional Blueprint Plan can provide information indicating whether the project could have significant environmental impacts related to GHG emissions. (*Ibid.*) Regional Blueprint Plans may, therefore, provide evidence to assist the lead agency in determining whether a project may tend to increase or decrease GHG emissions relative to the existing baseline. Thus, where such a plan has been developed and adopted by an MPO, lead agencies may find it useful to evaluate the project's consistency with that Blueprint Plan.

Greenhouse Gas Reduction Plans

The Proposed Amendments would add greenhouse gas reduction plans to the list of plans in section 15125(d). Many local and regional plans now include policies relating to, and analyses of, GHG emissions. (OPR, Book of Lists, at pp. 92-100; Scoping Plan, at p. 26.) Many such plans include detailed information on the jurisdiction's inventory of GHG emissions and measures to reduce such emissions. (*Ibid.*) Such plans may also include prescriptions for specific mitigation measures to address GHG emissions. (Scoping Plan, Appendix C, at p. C-49.) Where such a plan has been developed and adopted within the relevant jurisdiction, a project's inconsistency with that plan could be an indication of potential adverse environmental impacts.

Notably, while section 15125(d) requires an EIR to discuss any inconsistencies of a project with the listed plans, it does not mandate a finding of significance resulting from any identified inconsistencies. The plans simply provide information regarding the project's existing setting and inconsistency may be an indication of potentially significant impacts. The determination of significance is to be made by the lead agency.

Necessity

The Legislature directed OPR and the Resources Agency to develop guidelines addressing the mitigation of GHG emissions and the effects of the GHG emissions. (Pub. Resources Code, § 21083.05.) As indicated above, one potential indicator of a project's potential GHG emissions impacts is whether the project is consistent with applicable plans that have addressed that impact. Thus, the addition of plans that may address GHG emissions to the list of plans in the existing section 15125 is reasonably necessary to ensure that such analysis occurs.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action

is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific statutory CEQA provisions and/or case law interpreting CEQA for analyzing the effects of GHG emissions that may result from proposed projects. Many lead agencies, and some trial courts, have already determined that CEQA requires analysis and mitigation of GHG emissions independent of the SB97 CEQA Guidelines amendments. The Office of Planning and Research, for example, has cataloged over 1,000 examples of CEQA documents, prepared between July 2006 and June 2009, analyzing and mitigating GHG emissions. (Office of Planning and Research, Environmental Assessment Documents Containing a Discussion of Climate Change (Revised June 1, 2009).) Further, several trial courts have found that existing CEQA law requires analysis and mitigation of GHG emissions. (See, e.g., *Muriettans for Smart Growth v. City of Murrieta et al*., Riverside Co. Sup. Ct. Case No. RIC463320 (November 21, 2007); *Env. Council of Sac. et al v. Cal. Dept. of Trans*., Sacramento Sup. Ct. Case No. 07CS00967 (July 15, 2008) (citing *Berkeley Keep Jets Over the Bay Committee v. Board of Commissions* (2001) 91 Cal.App. 4th 1344, 1370-1371 and State CEQA Guidelines section 15144 as requiring a lead agency to "meaningfully attempt to quantify the Project's potential impacts on GHG emissions and determine their significance" or at least to explain what steps were undertaken to investigate the issue before concluding that the impact would be speculative).) Finally, federal courts have interpreted the National Environmental Policy Act ("NEPA") to require an analysis of potential impacts of GHG emissions. (*See*, *e.g.*, *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Ad*., 538 F.3d 1172, 1215-1217 (9th Cir. 2008).) Thus, the amendments to the CEQA Guidelines developed pursuant to SB97 do not create new requirements; rather, they interpret and clarify existing CEQA law.

Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California. On the contrary, the proposed amendments to this section are intended to reduce the costs of environmental review on lead agencies and project applicants by encouraging the use of existing environmental information where available. (Pub. Resources Code, § 21003(d) (use information in existing EIRs in order to reduce duplication), (f) (environmental review should proceed in the most efficient manner possible).)

SECTION 15126.2. CONSIDERATION AND DISCUSSION OF SIGNIFICANT ENVIRONMENTAL EFFECTS

The proposed revision to this section adds a cross-reference to the Public Resources Code and another section of the State CEQA Guidelines. This revision, therefore, qualifies as a "change without regulatory effect" pursuant to section 100(a)(4) of the Office of Administrative Law's regulations governing the rulemaking process. (Cal. Code Regs., tit. 1, § 100(a)(4).)

SECTION 15126.4. CONSIDERATION AND DISCUSSION OF MITIGATION MEASURES PROPOSED TO MINIMIZE SIGNIFICANT EFFECTS

Specific Purposes of the Amendment

Section 21083.05 of the Public Resources Code expressly requires OPR and the Resources Agency to develop regulations on the "mitigation of greenhouse gas emissions." The goals of this legislative mandate are to (1) reduce GHG emissions and (2) to provide consistency in the development of GHG emissions reduction measures. There is no indication, however, that the Legislature intended to alter any existing laws governing mitigation under CEQA. The Proposed Amendments, therefore, interpret and make specific existing CEQA law and regulations for mitigation of significant impacts resulting from GHG emissions. The proposed amendments identify five general methods of mitigation that may be tailored to the specific circumstances surrounding a specific project.

Mitigation Identified in an Existing Plan

The first type of mitigation of GHG emissions that may be considered includes measures identified in an existing plan. As indicated above, many agencies are beginning to address GHG emissions at a planning level. (OPR, Book of Lists, at pp. 92-100.) Some of those GHG reduction plans include specific measures that may be applied on a project-by-project basis. (*Ibid*; *see also* Scoping Plan, Appendix C, at p. C-49.) Proposed subdivision (c)(1), therefore, would encourage lead agencies to look to adopted plans for sources of mitigation measures that could be applied to specific projects.

Project Design Features

The second type of measure that a lead agency should consider is project design features that will reduce project emissions. Various project design features could be used to reduce GHG emissions from a wide variety of projects. The CAPCOA White Paper provides examples of various project design features that may reduce emissions from commercial and residential buildings. (CAPCOA White Paper, at pp. B-13 to B-18.) For example, according to the California Energy Commission, "[r]esearch shows that increasing a community's density and its accessibility to jobs centers are the two most significant factors for reducing vehicle miles traveled," which is an important component of reducing statewide emissions. (California Energy Commission 2007, *2007 Integrated Energy Policy Report*, CEC-100-2007-008-CMF ("2007 IEPR"), at p. 12; see also CEC, *The Role of Land Use in Meeting California's Energy and Climate Goals* (2007) at p. 20.) This subdivision also refers specifically to measures identified in Appendix F, which include a variety of measures designed to reduce energy use. By encouraging lead agencies to consider changes to the project itself, this subdivision further encourages the realization of co-benefits such as reduced energy costs for project occupants, increased amenities for non-vehicular transportation, and others. Thus, project design can reduce GHG emissions directly through efficiency and

indirectly through resource conservation and recycling. (Green Building Sector Subgroup of the Climate Action Team, Scoping Plan Measure Development and Cost Analysis (2008) at p. 6 to 9.)

Off-Site Measures

The third type of measures addressing GHG emissions is off-site measures and offsets. Proposed subdivision (c)(3) recognizes the availability of various off-site mitigation measures. Such measures could include, among others, the purchase of carbon offsets, community energy conservation projects, and off-site forestry projects. (*See*, *e.g.*, South Coast Air Quality Management District, SoCal Climate Solutions Exchange (June 2008), at pp.1; Rodeo Refinery Settlement Agreement, BAAQMD Carbon Offset Fund; Recommendations of the ETAAC, Final Report (February 2008) at pp. 9-5; ARB, Staff Report: Proposed Adoption of California Climate Action Registry Forestry Greenhouse Gas Protocols for Voluntary Purposes (October 17, 2007), at p. 15 ("[t]he three protocols together – the sector, project, and certification protocols – are a cohesive and comprehensive set of methodologies for forest carbon accounting, and furthermore contain all the elements necessary to generate high quality carbon credits"); see also Scoping Plan, Appendix C, at pp. C-21 to C-23.) Off-site mitigation may be appropriate under various circumstances. For example, such mitigation may be appropriate where a project is incapable of design modifications that would sufficiently reduce GHG emissions within the project boundaries. In that case, a lead agency could consider whether emissions reductions may be achieved through such measures as energy-efficiency upgrades within the community or reforestation programs.

Sequestration

The fourth type of GHG emissions mitigation measure is sequestration. Indeed, one way to reduce a project's GHG emissions is to sequester project-related GHG emissions and thereby prevent them from being released into the atmosphere. At present, the most readily available, and accountable, way to sequester GHGs is forest management. California forests have a "unique capacity to remove [carbon dioxide, a GHG,] from the air and store it long-term as carbon." (Scoping Plan, Appendix C, at p. C-165.) Forest sequestration functions are, therefore, a key part of the ARB's Scoping Plan and reduction effort. (Scoping Plan, at pp. 64-65.)

The California Climate Action Team has also identified several forest-related sequestration strategies, including, reforestation, conservation forest management, conservation (i.e., avoided development), urban forestry, and fuels management and biomass. (ARB, Staff Report: Proposed Adoption of California Climate Action Registry Forestry Greenhouse Gas Protocols for Voluntary Purposes (October 17, 2007), at pp. 6-7.) ARB has adopted Forest Protocols for large forestry projects. (ARB, Resolution 07-44 (adopting California Climate Action Registry Forestry Sector Protocol (September 2007), Forest Project Protocol (September 2007) and Forest Verification Protocol (May 2007).) ARB has also adopted Urban Forest Protocols for urban forestry projects. (California Climate Action Registry, Urban Forest Project Reporting Protocol and

Verification Protocol (August 2008) (ARB adopted on September 25, 2008).) Such projects could be located on the project site or off-site. (Urban Forest Project Reporting Protocol, at pp. 4-5.) The protocols include methods of measuring the ability of various forestry projects to store capture and store carbon.

Consistent with section 15126.4(a), a lead agency must support its choice of, and its determination of the effectiveness of, any reduction measures with substantial evidence. Substantial evidence in the record must demonstrate that any mitigation program or measure is reasonably likely to result in actual emissions reductions. As a practical matter, where a mitigation program or measure is consistent with protocols adopted or approved by an agency with regulatory authority to develop such a program, a lead agency will more easily be able to demonstrate that off-site mitigation will actually result in emissions reductions. Examples of such protocols include the forestry protocols described above. Where a mitigation proposal cannot be verified with an existing protocol, a greater evidentiary showing may be required.

Measures to be Implemented on a Project-by-Project Basis

Finally, the fifth type of measure that could reduce GHG emissions at a planning level is the development of binding measures to be implemented on a project-specific basis. As explained in greater detail in the discussion of proposed section 15183.5, below, ARB's Scoping Plan strongly encourages local agencies to develop plans to reduce GHG emissions throughout the community. In addition, the CEC's Power Plant Siting Committee is assessing the impacts of GHG emission from proposed new power plants and how they can be mitigated. Comments received during the CEC's informational proceedings warranted a lengthy discussion on the practical application of a programmatic approach to mitigating GHG emissions from new power plants. (CEC, *Committee Guidance on Fulfilling California Environmental Quality Act Responsibilities for Greenhouse Gas Impacts in Power Plant Siting Applications* (2009) at p. 26 to 28.) Existing State CEQA Guidelines sections 15168(b)(4) and 15168(c)(3) recognize that programmatic documents provide an opportunity to develop mitigation plans that will apply on a project-specific basis. Proposed subdivision (c)(5) recognizes that, for a planning level decision, appropriate mitigation of GHG emissions may include the development of a program to be implemented on a project-by-project basis. (State CEQA Guidelines, § 15126.4(a)(2) ("[i]n the case of the adoption of a plan, policy, regulation, or other public project, mitigation measures can be incorporated into the plan, policy, regulation or project design").)

This type of mitigation is subject to the limits of existing law, however. Thus, proposed subdivision (c)(5) should not be interpreted to allow deferral of mitigation. Rather, it is subject to the rule in existing section 15126.4(a)(1)(B) that such measures "may specify performance standards which would mitigate the significant effect of the project and which may be accomplished in more than one specified way." (*See also San Joaquin Raptor Rescue Center v. County of Merced* (2007) 149 Cal. App. 4th 645, 670-71.)

Suggestions Rejected

During its public involvement process, OPR received comments on its preliminary draft of the proposed amendments related to mitigation. Some comments suggested provisions that were not included in these Proposed Amendments. Several comments, for example, suggested that the Guidelines provide a specific "hierarchy" of mitigation requiring lead agencies to mitigate GHG emissions on-site where possible, and to allow consideration and use of off-site mitigation only if on-site mitigation is impossible or insufficient. OPR and the Resources Agency recognize that there may be circumstances in which requiring on-site mitigation may result in various co-benefits for the project and local community. However, CEQA leaves the determination of the precise method of mitigation to the discretion of lead agencies. (State CEQA Guidelines, § 15126.4(a)(1)(B); *see also San Franciscans Upholding the Downtown Plan v. City & Co. of San Francisco* (2002) 102 Cal. App. 4th 656, 697.)

Several comments also suggested that mitigation for GHG emissions must be "real, permanent, quantifiable, verifiable, and enforceable." The Proposed Amendments do not include such standards, however, for several reasons. The proposed standard appears to have been derived from section 38562(d) of the Health and Safety Code, which prescribes requirements for regulations to be promulgated to implement AB32. AB32 is a separate statutory scheme, and, as noted above, there is no indication that the legislature intended to alter standards for mitigation under CEQA. Similarly, standards for mitigation under CEQA already exist and are set out in section 15126.4(a). Specifically, mitigation must be fully enforceable, which implies that the measure is also real and verifiable. Additionally, substantial evidence in the record must support an agency's conclusion that mitigation will be effective, and in the context of an EIR, courts will defer to an agency's determination of a measure's effectiveness. (*Environmental Council of Sacramento v. City of Sacramento* (2006) 147 Cal.App.4th 1018, 1041 (mitigation ratio is supportable even at less than 1:1 given the project's circumstances); *Ass'n of Irritated Residents v. County of Madera* (2003) 107 Cal.App.4th 1383, 1398 (lead agency has discretion to resolve dispute regarding the effectiveness of an EIR's mitigation measures).) No existing law requires CEQA mitigation to be quantifiable. Rather, mitigation need only be "roughly proportional" to the impact being mitigated. (State CEQA Guidelines, § 15126.4(a)(4)(B); see also id. at § 15142.)

Necessity

The Legislature directed OPR and the Resources Agency to develop guidelines on the mitigation of GHG emissions. (Pub. Resources Code, § 21083.05.) The proposed subdivision (c) sets out types of mitigation of GHG emissions that a lead agency may consider. Thus, that subdivision is reasonably necessary to implement the Legislature's directive.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific statutory CEQA provisions and/or case law interpreting CEQA for mitigating the impacts of GHG emissions that may result from proposed projects. Many lead agencies, and some trial courts, have already determined that CEQA requires analysis and mitigation of GHG emissions independent of the SB97 CEQA Guidelines amendments. The Office of Planning and Research, for example, has cataloged over 1,000 examples of CEQA documents, prepared between July 2006 and June 2009, analyzing and mitigating GHG emissions. (Office of Planning and Research, Environmental Assessment Documents Containing a Discussion of Climate Change (Revised June 1, 2009).) Further, several trial courts have found that existing CEQA law requires analysis and mitigation of GHG emissions. (See, e.g., *Muriettans for Smart Growth v. City of Murrieta et al.*, Riverside Co. Sup. Ct. Case No. RIC463320 (November 21, 2007); *Env. Council of Sac. et al v. Cal. Dept. of Trans.*, Sacramento Sup. Ct. Case No. 07CS00967 (July 15, 2008) (citing *Berkeley Keep Jets Over the Bay Committee v. Board of Commissions* (2001) 91 Cal.App. 4th 1344, 1370-1371 and State CEQA Guidelines section 15144 as requiring a lead agency to "meaningfully attempt to quantify the Project's potential impacts on GHG emissions and determine their significance" or at least to explain what steps were undertaken to investigate the issue before concluding that the impact would be speculative).) Finally, federal courts have interpreted the National Environmental Policy Act ("NEPA") to require an analysis of potential impacts of GHG emissions. (*See*, *e.g.*, *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Ad.*, 538 F.3d 1172, 1215-1217 (9th Cir. 2008).) Thus, the amendments to the CEQA Guidelines developed pursuant to SB97 do not create new requirements; rather, they interpret and clarify existing CEQA law.

Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California. On the contrary, by providing greater certainty to lead agencies regarding the determination of significance of GHG emissions, the cost of environmental analysis, and potential litigation, may be reduced.

SECTION 15130. DISCUSSION OF CUMULATIVE IMPACTS

Specific Purposes of the Amendment

The Proposed Amendments include two revisions to the existing section 15130 of the State CEQA Guidelines. The two proposed amendments are described below.

Section 15130(b)(1)(B)

Section 21083(b) of the Public Resources Code requires that an EIR be prepared if the "possible effects of a project are individually limited but cumulatively considerable." That section further defines "cumulatively considerable" to mean that "the incremental effects of an individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects."

In determining whether a project may have significant cumulative impacts, a lead agency must engage in a two-step process. First, it must determine the extent of the cumulative problem. To do so, a lead agency must examine the "effects of past projects, the effects of other current projects, and the effects of probable future projects." Once it does so, the lead agency then determines whether the project's incremental contribution to that problem is cumulatively considerable. Section 21100(e) further provides that "[p]reviously approved land use documents, including but not limited to, general plans, specific plans, and local coastal plans, may be used in a cumulative impact analysis."

The existing Guideline section 15130(b) addresses the first step of the process. It offers two options for estimating the effects resulting from past, present and reasonably foreseeable projects. A lead agency may either rely on a list of such projects, or a summary of projections to estimate cumulative impacts. Existing section 15130(b)(1)(B) allows a lead agency to rely on projections in a land use document or certified environmental document that addresses the cumulative impact under consideration.

The proposed amendments would clarify that plans providing such projections need not be limited to land use plans, so long as the plan evaluates the relevant cumulative effect. The proposed amendments would also allow a lead agency to rely on information provided in regional modeling programs. The best projections of the cumulative effect of GHG emissions may be available in up-to-date models such as the International Council for Local Environmental Initiative's Local Government GHG Protocol[8] and the California Climate Action Reserve's Registry general,[9] industry[10] and

[8] ICLEI (2008) Local Government Operations Protocol; Accessed 6/08/09, http://www.icleiusa.org/action-center/tools/lgo-protocol-1

[9] California Climate Action Registry (2009) General Reporting Protocol: Accessed 6/08/09, http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf

project type protocols.[11] Such projections may also be supplied in plans that are not strictly "land use" plans. For example, regional transportation plans in certain areas will ultimately include sustainable community strategies which will include projections a region's GHG emissions and related cumulative effects. (Gov Code, § 65080(b)(2).) Finally, some agencies are beginning to develop GHG reduction plans or climate action plans that may also include such projections. (ARB, Scoping Plan, Appendix C, at p. C-49; OPR, Book of Lists, at pp. 92-100.)

The proposed amendments are consistent with section 21083 of the Public Resources Code and CEQA case law. Section 21083 requires consideration of "the effects of past projects, the effects of other current projects, and the effects of probable future projects." Projections in the listed types of plans and models may include inventories of existing emissions and projected future emissions. Section 21100 of the Public Resources Code provides that land use plans "may" be used in a cumulative impacts analysis, but that section does not purport to limit the types of plans that can be used in a cumulative impacts analysis to land use plans. Finally, case law has supported reliance on projections provided by industry, for example, to satisfy the requirement for a discussion of impacts caused by closely related projects. (*Ass'n of Irritated Residents*, *supra*, 107 Cal. App. 4th at 1404.)

While models may provide the most up to date information, lead agencies should still look first to information provided in adopted or certified environmental documents. First, such information has already gone through a public and agency review process. Second, to the extent the model provides information that is not provided in the prior environmental document, the relationship of the model and applicable plans must be explained, along with any changes in circumstances.

Section 15130(f)

Proposed subdivision (f) clarifies that sections 21083 and 21083.05 of the Public Resources Code do not require a detailed analysis of GHG emissions solely due to the emissions of other projects. (State CEQA Guidelines, § 15130(a)(1); *Santa Monica Chamber of Commerce v. City of Santa Monica* (2002) 101 Cal.App.4th 786, 799.) Rather, proposed subdivision (f) provides that a detailed analysis is required when evidence shows that the incremental contribution of the project's GHG emissions is cumulatively considerable when added to other cumulative projects. (*CBE*, *supra*, 103 Cal.App.4th at 119-120.) Analysis of GHG emissions as a cumulative impact is consistent with case law arising under the National Environmental Policy Act. (*See*, *e.g.*, *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Ad.*, 538 F.3d 1172, 1215-1217 (9th Cir. 2008).) Other portions of these proposed Guidelines address how lead agencies may determine whether a project's emissions are cumulatively considerable. (See, e.g., Proposed Sections 1506(h)(3) and 15064.4.)

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[10] California Climate Action Registry (2005) Industry Specific Protocols: Accessed 06/08/09, http://www.climateregistry.org/tools/protocols/industry-specific-protocols.html

[11] California Climate Action Registry (2007) Project Protocols: Accessed 06/08/09, http://www.climateregistry.org/tools/protocols/project-protocols.html

This clarification is reasonably necessary because OPR has observed that some lead agencies have avoided an analysis of a project's GHG emissions by claiming that no one project could be responsible for climate change. OPR has similarly observed that public comments on some projects have focused on the cumulative global effects of GHG emissions, without providing evidence related to the project under consideration. The proposed amendment would state clearly that both elements (the incremental contribution and the cumulative effect) are required in the analysis of GHG emissions.

Necessity

Sections 21083 and 21083.05 of the Public Resources Code respectively require that an EIR analyze cumulative impacts and that the effects of GHG emissions be analyzed in CEQA documents. The Proposed Amendments include guidance to assist lead agencies to evaluate the cumulative impacts of GHG emissions where an EIR is required. Thus, the Proposed Amendments are reasonably necessary to implement the Legislature's directive.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific statutory CEQA provisions and/or case law interpreting CEQA for analysis and mitigation of GHG emissions that may result from proposed projects. Many lead agencies, and some trial courts, have already determined that CEQA requires analysis and mitigation of GHG emissions independent of the SB97 CEQA Guidelines amendments. The Office of Planning and Research, for example, has cataloged over 1,000 examples of CEQA documents, prepared between July 2006 and June 2009, analyzing and mitigating GHG emissions. (Office of Planning and Research, Environmental Assessment Documents Containing a Discussion of Climate Change (Revised June 1, 2009).) Further, several trial courts have found that existing CEQA law requires analysis and mitigation of GHG emissions.

(See, e.g., *Muriettans for Smart Growth v. City of Murrieta et al*., Riverside Co. Sup. Ct. Case No. RIC463320 (November 21, 2007); *Env. Council of Sac. et al v. Cal. Dept. of Trans*., Sacramento Sup. Ct. Case No. 07CS00967 (July 15, 2008) (citing *Berkeley Keep Jets Over the Bay Committee v. Board of Commissions* (2001) 91 Cal.App. 4th 1344, 1370-1371 and State CEQA Guidelines section 15144 as requiring a lead agency to "meaningfully attempt to quantify the Project's potential impacts on GHG emissions and determine their significance" or at least to explain what steps were undertaken to investigate the issue before concluding that the impact would be speculative).) Finally, federal courts have interpreted the National Environmental Policy Act ("NEPA") to require an analysis of potential impacts of GHG emissions. (*See*, *e.g.*, *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Ad*., 538 F.3d 1172, 1215-1217 (9th Cir. 2008).) Thus, the amendments to the CEQA Guidelines developed pursuant to SB97 do not create new requirements; rather, they interpret and clarify existing CEQA law.

Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California. On the contrary, the proposed amendments to this section are intended to reduce the costs of environmental review on lead agencies and project applicants by encouraging the use of existing environmental analysis where available. (Pub. Resources Code, § 21003(d) (use information in existing EIRs in order to reduce duplication), (f) (environmental review should proceed in the most efficient manner possible).)

SECTION 15150. INCORPORATION BY REFERENCE

Specific Purposes of the Amendment

The existing CEQA Guidelines allow lead agencies to incorporate information from other documents by reference. (State CEQA Guidelines, § 15150.) Doing so permits a lead agency to avoid repetitious analysis of general matters and to reduce paperwork. (Pub. Resources Code § 21003 (it is state policy that "persons and public agencies involved in the environmental review process be responsible for carrying out the process in the most efficient, expeditious manner in order to conserve the available financial, governmental, physical, and social resources with the objective that those resources may be better applied toward the mitigation of actual significant effects on the environment").) Existing Guidelines section 15150(f) provides that "[i]ncorporation by reference is most appropriate for including long, descriptive, or technical materials that provide general background but do not contribute directly to the analysis of the problem at hand."

The key requirements for documents that may be incorporation by reference are set forth in the statutory definition of "EIR." (Pub. Resources Code, § 21061.) Those requirements include:

- The incorporated information is a matter of public record or is generally available to the public; and
- The incorporated information is reasonably available for inspection at a public place or public building.

Descriptions of global, statewide and regional GHG emissions are particularly well-suited to incorporation by reference. Such descriptions can be technical and lengthy. (Public Policy Institute of California, Climate Policy at the Local Level: A Survey of California's Cities and Counties (November 2008), at pp. 24-32 (describing barriers and constraints to adoption of climate action plans and policies).) General descriptions may also remain current enough to be used in several successive environmental documents. In fact, OPR has found that many agencies are addressing GHG emissions in programmatic documents that could be incorporated by reference into later documents. (OPR, Book of Lists, at pp. 92-100.) Thus, the Resources Agency and OPR find that proposed subdivision (e)(4) is reasonably necessary to effectuate the legislative directive that public agencies conduct environmental review in the most efficient manner possible.

Necessity

The Legislature directed OPR and the Resources Agency to develop guidelines on the analysis of GHG emissions. (Pub. Resources Code, § 21083.05.) The Legislature has further directed that resources be conserved wherever possible in the analysis of environment impacts. (*Id*. at § 21003.) Thus, the amendment to add GHG

analyses to the list of documents that may be incorporated by reference is reasonably necessary to implement the Legislature's directive.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific statutory CEQA provisions and/or case law interpreting CEQA for analysis and mitigation of GHG emissions that may result from proposed projects. Many lead agencies, and some trial courts, have already determined that CEQA requires analysis and mitigation of GHG emissions independent of the SB97 CEQA Guidelines amendments. The Office of Planning and Research, for example, has cataloged over 1,000 examples of CEQA documents, prepared between July 2006 and June 2009, analyzing and mitigating GHG emissions. (Office of Planning and Research, Environmental Assessment Documents Containing a Discussion of Climate Change (Revised June 1, 2009).) Further, several trial courts have found that existing CEQA law requires analysis and mitigation of GHG emissions. (See, e.g., *Muriettans for Smart Growth v. City of Murrieta et al.*, Riverside Co. Sup. Ct. Case No. RIC463320 (November 21, 2007); *Env. Council of Sac. et al v. Cal. Dept. of Trans.*, Sacramento Sup. Ct. Case No. 07CS00967 (July 15, 2008) (citing *Berkeley Keep Jets Over the Bay Committee v. Board of Commissions* (2001) 91 Cal.App. 4th 1344, 1370-1371 and State CEQA Guidelines section 15144 as requiring a lead agency to "meaningfully attempt to quantify the Project's potential impacts on GHG emissions and determine their significance" or at least to explain what steps were undertaken to investigate the issue before concluding that the impact would be speculative).) Finally, federal courts have interpreted the National Environmental Policy Act ("NEPA") to require an analysis of potential impacts of GHG emissions. (*See*, *e.g.*, *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Ad.*, 538 F.3d 1172, 1215-1217 (9th Cir. 2008).) Thus, the amendments to the CEQA Guidelines developed pursuant to SB97 do not create new requirements; rather, they interpret and clarify existing CEQA law.

Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California. On the contrary, the proposed amendments to this section are intended to reduce the costs of environmental review on lead agencies and project applicants by encouraging the use of existing environmental analysis where available. (Pub. Resources Code, § 21003(d) (use information in existing EIRs in order to reduce duplication), (f) (environmental review should proceed in the most efficient manner possible).)

SECTION 15183. PROJECTS CONSISTENT WITH A COMMUNITY PLAN OR ZONING

Specific Purposes of the Amendment

Section 21083.3 of the Public Resources Code provides that projects that are consistent with a General Plan, Community Plan or Zoning may not need to analyze cumulative effects that have already been analyzed in an EIR on the prior planning or zoning action. The exemption may apply, for example, where "uniformly applied development policies or standards" will substantially mitigate a cumulative effect. (Pub. Resources Code, § 21083.3(d).) The statute does not define what types of development policies or standards may be used in this context. It does provide, however, that such standards or policies must have been adopted by the lead agency with a finding, supported with substantial evidence, that the policy or standard will substantially mitigate the environmental effect under consideration. (*Ibid.*) Existing Guidelines section 15183 provides several non-exclusive examples of policies and standards that might apply in the context of section 21083.3, including grading ordinances and floodplain protection ordinances.

The inclusion of "[r]equirements for reducing greenhouse gas emissions, as set forth in an adopted land use plan, policy or regulation" among the list of examples of "uniformly applied development policies or standards" is consistent with the direction in section 21083.3. First, the text provides that such requirements would be "adopted" by the lead agency. Second, they would be "development policies or standards" because the requirements would be contained in an adopted "land use plan, policy or regulation." Finally, such requirements could substantially mitigate the effects of GHG emissions by "reducing greenhouse gas emissions" in the adopting jurisdiction. (Proposed Section 15183.5(b) would provide elements that may be included in a GHG emissions reduction plan that might be used in the context of section 15183.)

One comment submitted during OPR's public involvement process questioned whether such requirements relating to reductions in GHG emissions would be kept current. (See, e.g., Letter from Joyce Dillard to OPR, January 26, 2009.) Section 21083.3 specifically provides, however, that such requirements would not apply in this context if "substantial new information shows that the policies or standards will not substantially mitigate the environmental effect." (Pub. Resources Code, § 21083.3(d).) Therefore, lead agencies have an incentive to ensure that their policies remain current.

Necessity

The Legislature directed OPR and the Resources Agency to develop guidelines on the analysis of GHG emissions. (Pub. Resources Code, § 21083.05.) The proposed addition to section 15183 is reasonably necessary to carry out the legislature's intent that projects that are consistent with General Plans, Community Plans and Zoning benefit from streamlined CEQA review. Several jurisdictions are beginning to include requirements for reducing GHG emissions in their general plans. (OPR, Book of Lists,

at pp. 92-100; Scoping Plan, Appendix C, at p. C-49.) The addition is also reasonably necessary to effectuate the legislature's intent that OPR and the Resources Agency provide guidance on how to analyze GHG emissions.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific statutory CEQA provisions and/or case law interpreting CEQA for analysis and mitigation of GHG emissions that may result from proposed projects. Many lead agencies, and some trial courts, have already determined that CEQA requires analysis and mitigation of GHG emissions independent of the SB97 CEQA Guidelines amendments. The Office of Planning and Research, for example, has cataloged over 1,000 examples of CEQA documents, prepared between July 2006 and June 2009, analyzing and mitigating GHG emissions. (Office of Planning and Research, Environmental Assessment Documents Containing a Discussion of Climate Change (Revised June 1, 2009).) Further, several trial courts have found that existing CEQA law requires analysis and mitigation of GHG emissions. (See, e.g., *Muriettans for Smart Growth v. City of Murrieta et al.*, Riverside Co. Sup. Ct. Case No. RIC463320 (November 21, 2007); *Env. Council of Sac. et al v. Cal. Dept. of Trans.*, Sacramento Sup. Ct. Case No. 07CS00967 (July 15, 2008) (citing *Berkeley Keep Jets Over the Bay Committee v. Board of Commissions* (2001) 91 Cal.App. 4th 1344, 1370-1371 and State CEQA Guidelines section 15144 as requiring a lead agency to "meaningfully attempt to quantify the Project's potential impacts on GHG emissions and determine their significance" or at least to explain what steps were undertaken to investigate the issue before concluding that the impact would be speculative).) Finally, federal courts have interpreted the National Environmental Policy Act ("NEPA") to require an analysis of potential impacts of GHG emissions. (*See*, *e.g.*, *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Ad.*, 538 F.3d 1172, 1215-1217 (9th Cir. 2008).) Thus, the amendments to the CEQA Guidelines developed pursuant to

SB97 do not create new requirements; rather, they interpret and clarify existing CEQA law.

Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California. On the contrary, the proposed amendments to this section are intended to reduce the costs of environmental review on lead agencies and project applicants by encouraging the use of existing environmental analysis where available. (Pub. Resources Code, § 21003(d) (use information in existing EIRs in order to reduce duplication), (f) (environmental review should proceed in the most efficient manner possible).)

SECTION 15183.5. TIERING AND STREAMLINING THE ANALYSIS OF GREENHOUSE GAS EMISSIONS

Specific Purposes of the Amendment

In adopting SB375, the Legislature found that "[n]ew provisions of CEQA should be enacted so that the statute encourages … local governments to make land use decisions that will help the state achieve its climate goals under AB 32[.]" (Statutes 2008, Ch. 728, § 1(f).) ARB's Scoping Plan similarly recognizes the important role that local governments play in reducing the State's GHG emissions. (ARB, Scoping Plan, at p. 26.) In particular, local government "[d]ecisions on how land is used will have large impacts on the GHG emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas sectors." (*Ibid.*) Decision-making on urban growth and land use planning begins with local general plans. (Gov. Code, § 65030.1 ("The Legislature … finds that decisions involving the future growth of the state, most of which are made and will continue to be made at the local level, should be guided by an effective planning process, including the local general plan, and should proceed within the framework of officially approved statewide goals and policies directed to land use, population growth and distribution, development, open space, resource preservation and utilization, air and water quality, and other related physical, social and economic development factors").)

GHG emissions may be best analyzed and mitigated at a programmatic level. "For local government lead agencies, adoption of general plan policies and certification of general plan EIRs that analyze broad jurisdiction-wide impacts of GHG emissions can be part of an effective strategy for addressing cumulative impacts and for streamlining later project-specific CEQA reviews." (OPR, Technical Advisory: CEQA and Climate Change: Addressing Climate Change Through California Environmental Quality Act (CEQA) Review, June 19, 2008, at p. 8.) Other lead agencies may also address GHG emissions programmatically in long range development plans, facilities master plans, and other long-range planning documents.

This emphasis on long-range planning is consistent with state policy expressed in CEQA. The Legislature has clearly stated its preference that lead agencies tier environmental documents wherever feasible. (Pub. Resources Code, § 21093(b).) Specifically:

> The Legislature finds and declares that tiering of environmental impact reports will promote construction of needed housing and other development projects by (1) streamlining regulatory procedures, (2) avoiding repetitive discussions of the same issues in successive environmental impact reports, and (3) ensuring that environmental impact reports prepared for later projects which are consistent with a previously approved policy, plan, program, or ordinance concentrate upon environmental effects which may be mitigated or avoided in connection with the decision on each later project. The Legislature further finds and

> declares that tiering is appropriate when it helps a public agency to focus upon the issues ripe for decision at each level of environmental review and in order to exclude duplicative analysis of environmental effects examined in previous environmental impact reports.

(Pub. Resources Code, § 21093(a).) The Proposed Amendments, therefore, include the addition of a new section 15183.5 to address both tiering and streamlining of GHG analyses, as well as the proper use of GHG reduction plans in CEQA analyses. Explanation of the rationale of each proposed new subdivision is provided below.

Existing Methods of Streamlining and Tiering

Because GHG emissions raise a cumulative concern, analysis of such emissions in a long-range planning document lends itself to tiering and use in later project-specific environmental review. (Pub. Resources Code, § 21093.) The Legislature has created several tiering and streamlining methods that can reduce duplication in the analysis of GHG emissions. Proposed subdivision (a) clarifies existing statutory provisions in CEQA to provide that GHG analyses are appropriate subjects for tiering and streamlining.

Greenhouse Gas Emissions Reduction Plans

Many jurisdictions are beginning to address GHG emissions reductions in "climate action plans" and "gas emissions reduction plans." (OPR, Book of Lists, at pp. 92-100; see also, Scoping Plan, Appendix C, at p. C-49.) ARB's Scoping Plan specifically encourages local governments to develop such plans, and has created a local government operations protocol to assist in that effort. (Scoping Plan, at p. 26.) A community-wide emissions protocol is also under development.

Some comments raised during OPR's public involvement process expressed concern that due to a lack of legislative criteria for such plans, existing provisions in the CEQA Guidelines regarding cumulative impacts may be misused. (See, e.g., Letter from Center for Biological Diversity, et al., to OPR, February 2, 2009, at p. 2.) For example, without specific guidance, a lead agency could erroneously rely on a plan with purely aspirational intent to determine that a later project's cumulative impact is less than significant pursuant to section 15064(h)(3). The proposed subdivision (b) provides non-exclusive criteria to assist lead agencies in determining whether an existing greenhouse gas reduction plan is an appropriate document to use in a cumulative impacts analysis under CEQA.

The existing CEQA Guidelines allow lead agencies to rely on plans for cumulative analysis where the plan has been adopted in a public review process and contains specific requirements to avoid or substantially lessen a cumulative problem. (State CEQA Guidelines, § 15064(h)(3).) The criteria set out in proposed subdivision (b)(1) are designed to ensure that a greenhouse gas reduction plan would satisfy the

requirements described in sections 15064(h)(3) and 15130(d), for the reasons described below.

Criteria (A) and (C) are necessary to define the scope of GHG emissions within the defined geographic area and the incremental contribution of activities that will occur within that area to those emissions. (State CEQA Guidelines, § 15064(h)(3) (plan addresses cumulative impacts "within the geographic area in which the project is located").) Criterion (B) establishes a benchmark to assist the lead agency in determining whether the plan provisions will avoid or substantially lessen cumulative effects of the area's GHG emissions. (*Ibid*. (plan "provides specific requirements that will avoid or substantially lessen the cumulative problem").) Criteria (D) and (E) are necessary to demonstrate that the plan will actually avoid or substantially lessen the cumulative effects of those emissions. (*Ibid*.) Finally, criterion (F) reflects the requirement in sections 15064(h)(3) and 15130(d) that the plan be adopted through a public review process, as well as case law requiring that mitigation plans themselves undergo environmental review. (*California Native Plant Society v. County of El Dorado* (2009) 170 Cal. App. 4th 1026, 1053 (mitigation "programs may offer the best solution to environmental planning challenges, by providing some certainty to developers while adequately protecting the environment" but "in order to provide a lawful substitute for the 'traditional' method of mitigating CEQA impacts, that is, a project-by-project analysis, the fee program must be evaluated under CEQA").) Notably, the criteria provided in subdivision (b) are largely consistent with the elements that ARB recommends be included in a greenhouse gas reduction plan. (ARB, Scoping Plan, Appendix C, at p. C-49.)

Proposed subdivision (b)(2) describes the uses and limitations of greenhouse gas reduction plans in a cumulative analysis of later projects. Specifically, it provides a safeguard to ensure that the later activity was actually addressed in the greenhouse gas reduction plan, and that any applicable requirements of the plan are incorporated into the later project. This requirement is similar the requirement in case law that a lead agency determine that a particular threshold appropriately addresses the impact of concern. (*Protect the Historic Amador Waterways*, *supra*, 116 Cal.App.4th at 1109 ("in preparing an EIR, the agency must consider and resolve every fair argument that can be made about the possible significant environmental effects of a project, irrespective of whether an established threshold of significance has been met with respect to any given effect").) Finally, subdivision (b)(2) makes specific the requirement that, while the existence of an applicable greenhouse gas reduction plan may create a presumption that compliance with that plan will reduce the incremental contribution of later activities to a less than cumulatively considerable level, the existence of substantial evidence supporting a fair argument to the contrary may still require preparation of an EIR.

<u>Special Situations</u>

Proposed subdivision (c) provides necessary clarification of the partial exemption provided in sections 21155.2 and 21159.28 of the Public Resources Code, enacted as part of SB375 (see description above). The limitation on analysis of global warming

applies only to the effects caused by GHG emissions from cars and light duty trucks. That limitation should be read in conjunction with section 21083.05 of the Public Resources Code and proposed CEQA Guideline sections 15064.4 and 15126.4 which require analysis of all sources of GHG emissions and mitigation if those emissions are significant. Thus, projects that qualify for the limitation in sections 21155.2 and 21159.28 must still analyze emissions resulting from, as applicable, energy use, land conversion, and other direct and indirect sources of emissions. This clarification is reasonably necessary to effectuate the legislative directive in section 21083.3 that OPR and Resources develop guidelines on the analysis of GHG emissions and to avoid confusion regarding the streamlining provisions provided by SB375.

Necessity

The Legislature directed OPR and the Resources Agency to develop guidelines on the analysis of GHG emissions. (Pub. Resources Code, § 21083.05.) The Legislature has also directed that EIRs be tiered wherever possible, and that duplication be minimized. (*Id*. at §§ 21003, 21093, 21094.) Proposed section 15183.5, which provides guidance on tiering and streamlining of GHG emissions analyses, is therefore reasonably necessary to carry out these directives.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific statutory CEQA provisions and/or case law interpreting CEQA for analysis and mitigation of GHG emissions that may result from proposed projects. Many lead agencies, and some trial courts, have already determined that CEQA requires analysis and mitigation of GHG emissions independent of the SB97 CEQA Guidelines amendments. The Office of Planning and Research, for example, has cataloged over 1,000 examples of CEQA documents, prepared between July 2006 and June 2009, analyzing and mitigating GHG emissions.

(Office of Planning and Research, Environmental Assessment Documents Containing a Discussion of Climate Change (Revised June 1, 2009).) Further, several trial courts have found that existing CEQA law requires analysis and mitigation of GHG emissions. (See, e.g., *Muriettans for Smart Growth v. City of Murrieta et al*., Riverside Co. Sup. Ct. Case No. RIC463320 (November 21, 2007); *Env. Council of Sac. et al v. Cal. Dept. of Trans*., Sacramento Sup. Ct. Case No. 07CS00967 (July 15, 2008) (citing *Berkeley Keep Jets Over the Bay Committee v. Board of Commissions* (2001) 91 Cal.App. 4th 1344, 1370-1371 and State CEQA Guidelines section 15144 as requiring a lead agency to "meaningfully attempt to quantify the Project's potential impacts on GHG emissions and determine their significance" or at least to explain what steps were undertaken to investigate the issue before concluding that the impact would be speculative).) Finally, federal courts have interpreted the National Environmental Policy Act ("NEPA") to require an analysis of potential impacts of GHG emissions. (*See*, *e.g.*, *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Ad*., 538 F.3d 1172, 1215-1217 (9th Cir. 2008).) Thus, the amendments to the CEQA Guidelines developed pursuant to SB97 do not create new requirements; rather, they interpret and clarify existing CEQA law.

Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California. On the contrary, the proposed amendments to this section are intended to reduce the costs of environmental review on lead agencies and project applicants by encouraging the use of existing environmental analysis where available. (Pub. Resources Code, § 21003(d) (use information in existing EIRs in order to reduce duplication), (f) (environmental review should proceed in the most efficient manner possible).)

SECTION 15364.5. GREENHOUSE GAS

Specific Purposes of the Amendment

The Legislature has not included a definition of "greenhouse gases" in CEQA, though it did include a definition in AB32. (Health & Saf. Code, § 38505(g).) Thus, proposed new section 15364.5 adds a definition of greenhouse gases. The specified gases are consistent with existing law as they are defined to include those identified by the Legislature in section 38505(g) of the Health and Safety Code.

Notably, the definition in AB32 states that GHG "includes all of the following…." In so stating, the Legislature implies that other gases may also be considered GHGs. The ARB's Scoping Plan also acknowledges that other gases contribute to climate change. (Scoping Plan, at p. 11.) In fact, the EPA's Endangerment Finding explained that several other gases share attributes with GHGs but would not be appropriate for regulation under the Clean Air Act at this time. (EPA Endangerment Finding, at pp. 18896-98.) Therefore, similar to the statutory definition of GHGs in AB32, the proposed definition in the Proposed Amendments is not exclusive to the six primary GHGs. The purpose of a more expansive definition is to ensure that lead agencies do not exclude from consideration GHGs that are not listed, so long as substantial evidence indicates that such non-listed gases may result in significant adverse effects. This approach is consistent with the Supreme Court's directive that CEQA be interpreted to provide the fullest possible protection to the environment. (*Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal. 3d 376, 390.)

Necessity

The Legislature directed OPR and the Resources Agency to develop guidelines on the analysis of GHG emissions. (Pub. Resources Code, § 21083.05.) Proposed section 15364.5 is necessary to make specific the instruction to analyze GHG emissions because it states precisely which gases are considered to be "greenhouse gases" and should be included in the analysis.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives

available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific statutory CEQA provisions and/or case law interpreting CEQA for analysis and mitigation of GHG emissions that may result from proposed projects. Many lead agencies, and some trial courts, have already determined that CEQA requires analysis and mitigation of GHG emissions independent of the SB97 CEQA Guidelines amendments. The Office of Planning and Research, for example, has cataloged over 1,000 examples of CEQA documents, prepared between July 2006 and June 2009, analyzing and mitigating GHG emissions. (Office of Planning and Research, Environmental Assessment Documents Containing a Discussion of Climate Change (Revised June 1, 2009).) Further, several trial courts have found that existing CEQA law requires analysis and mitigation of GHG emissions. (See, e.g., *Muriettans for Smart Growth v. City of Murrieta et al.*, Riverside Co. Sup. Ct. Case No. RIC463320 (November 21, 2007); *Env. Council of Sac. et al v. Cal. Dept. of Trans.*, Sacramento Sup. Ct. Case No. 07CS00967 (July 15, 2008) (citing *Berkeley Keep Jets Over the Bay Committee v. Board of Commissions* (2001) 91 Cal.App. 4th 1344, 1370-1371 and State CEQA Guidelines section 15144 as requiring a lead agency to "meaningfully attempt to quantify the Project's potential impacts on GHG emissions and determine their significance" or at least to explain what steps were undertaken to investigate the issue before concluding that the impact would be speculative).) Finally, federal courts have interpreted the National Environmental Policy Act ("NEPA") to require an analysis of potential impacts of GHG emissions. (*See*, *e.g.*, *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Ad.*, 538 F.3d 1172, 1215-1217 (9th Cir. 2008).) Thus, the amendments to the CEQA Guidelines developed pursuant to SB97 do not create new requirements; rather, they interpret and clarify existing CEQA law.

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APPENDIX F. ENERGY CONSERVATION

Specific Purposes of the Amendment

CEQA's requirement to analyze and mitigate energy impacts of a project is substantive, and is not merely procedural. (*People v. County of Kern* (1976) 62 Cal.App.3d 761, 774.) Despite the requirement, lead agencies have not consistently included such analysis in their EIRs. (Remy et al., Guide to CEQA, 11th Ed. 2007, at pp. 1007-1008, n. 34.) The following revisions to Appendix F are, therefore, reasonably necessary to ensure that lead agencies comply with the substantive directive in section 21100(b)(3).

Introduction

The revisions to the introduction section include a cross-reference to section 21100(b)(3) of the Public Resources Code to direct lead agencies to the statutory directive underlying Appendix F. This section also includes an addition to make clear that energy impacts that have already been analyzed may not need to be repeated in later EIRs. This sentence is consistent with the Legislative intent in CEQA that information in existing environmental review be used to "reduce delay and duplication in preparation of subsequent environmental impact reports." (Pub. Resources Code, § 21003(d).)

EIR Contents

The proposed amendments revise the section on EIR Contents in Appendix F to clarify that lead agencies "shall" analyze energy conservation in their EIRs. The word "shall" indicates that the duty is mandatory, and makes Appendix F consistent with Public Resources Code section 21100(b)(3). While Appendix F is revised to make clear that an energy analysis is mandatory, the Proposed Amendments to this section would also make clear that the energy analysis is limited to effects that are applicable to the project.

"Lifecycle"

The proposed amendments to Appendix F remove the term "lifecycle." No existing regulatory definition of "lifecycle" exists. In fact, comments received during OPR's public workshop process indicate a wide variety of interpretations of that term. (Letter from Terry Rivasplata et al. to OPR, February 2, 2009, at pp. 5, 12 and Attachment; Letter from Center for Biological Diversity et al. to OPR, February 2, 2009, at pp. 17.) Thus, retention of the term "lifecycle" in Appendix F could create confusion among lead agencies regarding what Appendix F requires.

Moreover, even if a standard definition of the term "lifecycle" existed, requiring such an analysis may not be consistent with CEQA. As a general matter, the term could refer to emissions beyond the direct control of the project applicant or sponsor.

An example of such emissions could be those resulting from the manufacture of building materials. (CAPCOA White Paper, at pp. 50-51.) Analysis of lifecycle emissions, as that term is used here, may not be appropriate within a traditional CEQA analysis for several reasons. First, CEQA only requires analysis of impacts that are directly or indirectly attributable to the project under consideration. (State CEQA Guidelines, § 15064(d).) In many instances, materials would be manufactured for many different projects, and would likely do so whether or not one particular project proceeds. Thus, such emissions may not be "caused by" the project under consideration. Similarly, in this scenario, a lead agency may not be able to require mitigation for emissions that result from the manufacturing process. Mitigation can only be required for emissions that are actually caused by the project. (State CEQA Guidelines, § 15126.4(a)(4).) Second, emissions resulting from materials manufacture may already be accounted for in other regulations or environmental review. Including such emissions in a "lifecycle" analysis could lead to double-counting. Certainly where substantial evidence supports a fair argument that such "lifecycle" emissions are attributable to a project, that evidence must be considered. However, to avoid potential confusion, the term is proposed to be removed from Appendix F.

Types of Energy Use

The proposed amendments clarify that project design may achieve energy savings through measures related to water use and solid waste disposal. (California Energy Commission, Water Supply-Related Electricity Demand in California, CEC 500-2007-114 (November 2007), at p. 3 (reporting that water related energy use, including water movement, treatment and heating, annually accounts for approximately 20 percent of California's electricity consumption); Scoping Plan, Appendix C, at pp. C-158 to C-160.) The addition of these potential sources of energy reductions is consistent with the direction in section 21100(b)(3) to identify mitigation measures to reduce inefficient consumption of energy.

Grammar and Syntax

Finally, several minor revisions to Appendix F are proposed to improve grammar and syntax. Such revisions qualify as a "change without regulatory effect" pursuant to section 100(a)(4) of the Office of Administrative Law's regulations governing the rulemaking process. (Cal. Code Regs., tit. 1, § 100(a)(4).)

Necessity

The Legislature directed OPR and the Resources Agency to develop guidelines on the analysis and mitigation of GHG emissions. (Pub. Resources Code, § 21083.05.) Since a significant source of GHG emissions results from energy use (consumption), it is critical that these Proposed Amendments directly address energy use and conservation as a subject for CEQA analysis. Additionally, the legislature requires that lead agencies analyze energy use in their EIRs. (*Id*. at § 21100(b)(3).) The proposed

amendments to Appendix F are, therefore, necessary to ensure that lead agencies implement these directives.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific statutory CEQA provisions and/or case law interpreting CEQA's requirements for analysis and mitigation of energy use. Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California.

APPENDIX G. INITIAL STUDY CHECKLIST

Specific Purposes of the Amendment

The Proposed Amendments include revisions to several portions of Appendix G, which contains a sample environmental checklist that lead agencies may use to satisfy the requirement to prepare an initial study. The proposed amendments and their necessity are described below.

Note Regarding Use of the Checklist

The proposed amendments would add a note to the beginning of Appendix G to clarify the checklist contained therein is only a sample that may be modified as necessary to suit the lead agency and to address the particular circumstances of the project under consideration. The proposed addition is necessary for two reasons. First, several lead agencies have expressed concern that the checklist does not reflect the circumstances existing in that particular agency. (Letter from Napa County – Department of Conservation, Development, and Planning to OPR, January 26, 2009; Letter from County of San Bernardino - Land Use Services Department to OPR, February 2, 2009.) Second, the Third District Court of Appeal recently issued an opinion that clarified that all substantial evidence regarding potential impacts of a project must be considered, even if the particular potential impact is not listed in Appendix G. (*Protect the Historic Amador Waterways*, *supra*, 116 Cal.App.4th at 1109 ("in preparing an EIR, the agency must consider and resolve every fair argument that can be made about the possible significant environmental effects of a project, irrespective of whether an established threshold of significance has been met with respect to any given effect").) Thus, the proposed note emphasizes that Appendix G does not mandate a particular form that must be used for an Initial Study; rather, it provides merely an example.

Forest Resources

The proposed amendments would add several questions addressing forest resources in the section on Agricultural Resources. Forestry questions are appropriately addressed in the Appendix G checklist for several reasons. First, forests and forest resources are directly linked to both GHG emissions and efforts to reduce those emissions. For example, conversion of forests to non-forest uses may result in direct emissions of GHG emissions. (L. Wayburn et al., *A Programmatic Approach to the Forest Sector in AB32*, Pacific Forest Trust (May 2008); see also California Energy Commission Baseline GHG Emissions for Forest, Range, and Agricultural Lands in California (March, 2004) at p. 19.) Such conversion would also remove existing carbon stock (i.e., carbon stored in vegetation), as well as a significant carbon sink (i.e., rather than emitting GHGs, forests remove GHGs from the atmosphere). (Scoping Plan, Appendix C, at p. C-168.) Thus, such conversions are an indication of potential GHG emissions. Changes in forest land or timberland zoning may also ultimately lead to conversions, which could result in GHG emissions, aesthetic impacts, impacts to

biological resources and water quality impacts, among others. Thus, these additions are reasonably necessary to ensure that lead agencies consider the full range of potential impacts in their initial studies. In the same way that an EIR must address conversion of prime agricultural land or wetlands as part of a project (addressing the whole of the action requires analyzing land clearance in advance of project development), so should it analyze forest removal.

During OPR's public involvement process, some commenters suggested that conversion of forest or timber lands to agricultural uses should not be addressed in the Initial Study checklist. (Letter from California Farm Bureau Federation to OPR, February 2, 2009; Letter from County of Napa, Conservation, Development and Planning Department, to OPR, January 26, 2009.) As explained above, the purpose of the Proposed Amendments is to implement the Legislative directive to develop Guidelines on the analysis and mitigation of GHG emissions. Although some agricultural uses also provide carbon sequestration values, most agricultural uses do not provide as much sequestration as forest resources. (Climate Action Team, *Carbon Sequestration* (2009), Chapter 3.3.8 at p. 3.21; California Energy Commission, *Baseline GHG Emissions for Forest, Range, and Agricultural Lands in California* (2004), at p. 2.) Therefore, such a project could result in a net increase in GHG emissions, among other potential impacts. Thus, such potential impacts are appropriately addressed in the Initial Study checklist.

Greenhouse Gas Emissions

The proposed additions also include two questions related to GHG emissions. These questions are necessary to satisfy the Legislative directive in section 21083.05 that the effects of GHG emissions be analyzed under CEQA. The questions are intended to provoke a full analysis of such emissions where appropriate. More detailed guidance on the context of such an analysis is provided in other sections throughout the Guidelines. Despite the detailed provisions in the Guidelines themselves, questions related to GHG emissions should also appear in the checklist because some lead agencies will not seriously consider an environmental issue unless it is specifically mentioned in the checklist. (*Protect the Historic Amador Waterways*, *supra*, 116 Cal. App. 4th at 1110.)

Transportation

The Proposed Amendments make three primary changes to the questions involving transportation and traffic.

First, question (a) changes the focus from an increase in traffic at a given location to the effect of a project on the overall circulation system in the project area. This change is appropriate because an increase in traffic, by itself, is not necessarily an indicator of a potentially significant *environmental* impact. (Ronald Miliam, AICP, *Transportation Impact Analysis Gets a Failing Grade When it Comes to Climate Change and Smart Growth*; *see also* Land Use Subcommittee of the Climate Action Team

LUSCAT Submission to CARB Scoping Plan on Local Government, Land Use, and Transportation Report (May, 2008) at pp. 31, 36.) Similarly, even if some projects may result in a deterioration of vehicular level of service – that is, delay experienced by drivers – the overall effectiveness of the circulation system as a whole may be improved. (*Ibid*.) Such projects could include restriping to provide bicycle lanes or creating dedicated bus lanes. Even in such cases, however, any potential adverse air quality or other impacts would still have to be addressed as provided in other sections of the checklist. Finally, the change to question (a) also recognizes that the lead agency has discretion to choose its own metric of analysis of impacts to intersections, streets, highways and freeways. (Pub. Resources Code, § 21081.2(e); *Eureka Citizens for Responsible Gov't v. City of Eureka, supra,* 147 Cal.App.4th at 371-373 (lead agency has discretion to choose its methodology).) Thus, "level of service" may or may not be the applicable measure of effectiveness of the circulation system.

Second, the proposed revisions to question (b) clarify the role of a congestion management program in a CEQA analysis. Specifically, it clarifies that a congestion management program contains many elements in addition to a level of service designation. (Gov. Code § 65088 et seq.) The clarification is also necessary to address any projects within an "in-fill opportunity zone" that may be exempted from level of service requirements. (*Id*. at § 65088.4.)

Third, the proposed amendments would eliminate the existing question (f) relating to parking capacity. Case law recognizes that parking impacts are not necessarily environmental impacts. (*San Franciscans Upholding the Downtown Plan v. City and County of San Francisco, supra,* 102 Cal.App.4th at 697.) Therefore, the question related to parking is not relevant in the initial study checklist. As noted above, however, if there is substantial evidence indicating adverse environmental impacts from a project related to parking capacity, the lead agency must address such potential impacts regardless of whether the checklist contains parking questions. (*Ibid*.)

Necessity

The Legislature directed OPR and the Resources Agency to develop guidelines on the analysis of GHG emissions. (Pub. Resources Code, § 21083.05.) An initial study may be used to assist in the determination of whether a project may have a significant effect on the environment. (*Protect the Historic Amador Waterways*, *supra*, 116 Cal. App. 4th at 1110.) Appendix G of the State CEQA Guidelines is intended to provide a sample of an initial study that lead agencies may use. (*Ibid*.) Amendment of Appendix G to include questions that will assist a lead agency in determining whether a project may result in significant impacts related to GHG emissions is, therefore, necessary to carry out the Legislature's directive in section 21083.05 of the Public Resources Code.

Reasonable Alternatives to the Regulation, Including Alternatives that Would Lessen Any Adverse Impact on Small Business, and the Resources Agency's Reasons for Rejecting Those Alternatives

The Resources Agency considered reasonable alternatives to the proposed action and determined that no reasonable alternative would be more effective in carrying out the purpose for which the action is proposed or would be as effective as, and less burdensome to affected private persons than, the proposed action. This conclusion is based on the Resources Agency's determination that the proposed action is necessary to implement the Legislature's directive in SB97 in a manner consistent with existing statutes and case law, and the proposed action adds no new substantive requirements. The Resources Agency rejected the no action alternative because it would not achieve the objectives of the proposed revisions. There are no alternatives available that would lessen any adverse impacts on small businesses, as any impacts would result from the implementation of existing law.

Evidence Supporting an Initial Determination That the Action Will Not Have a Significant Adverse Economic Impact on Business

The proposed action interprets and makes specific statutory CEQA provisions and/or case law interpreting CEQA for analysis and mitigation of GHG emissions that may result from proposed projects. Many lead agencies, and some trial courts, have already determined that CEQA requires analysis and mitigation of GHG emissions independent of the SB97 CEQA Guidelines amendments. The Office of Planning and Research, for example, has cataloged over 1,000 examples of CEQA documents, prepared between July 2006 and June 2009, analyzing and mitigating GHG emissions. (Office of Planning and Research, Environmental Assessment Documents Containing a Discussion of Climate Change (Revised June 1, 2009).) Further, several trial courts have found that existing CEQA law requires analysis and mitigation of GHG emissions. (See, e.g., *Muriettans for Smart Growth v. City of Murrieta et al.*, Riverside Co. Sup. Ct. Case No. RIC463320 (November 21, 2007); *Env. Council of Sac. et al v. Cal. Dept. of Trans.*, Sacramento Sup. Ct. Case No. 07CS00967 (July 15, 2008) (citing *Berkeley Keep Jets Over the Bay Committee v. Board of Commissions* (2001) 91 Cal.App. 4th 1344, 1370-1371 and State CEQA Guidelines section 15144 as requiring a lead agency to "meaningfully attempt to quantify the Project's potential impacts on GHG emissions and determine their significance" or at least to explain what steps were undertaken to investigate the issue before concluding that the impact would be speculative).) Finally, federal courts have interpreted the National Environmental Policy Act ("NEPA") to require an analysis of potential impacts of GHG emissions. (*See*, *e.g.*, *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Ad.*, 538 F.3d 1172, 1215-1217 (9th Cir. 2008).) Thus, the amendments to the CEQA Guidelines developed pursuant to SB97 do not create new requirements; rather, they interpret and clarify existing CEQA law.

Because the proposed action does not add any substantive requirements, it will not result in an adverse impact on businesses in California. On the contrary, the

proposed amendments to this section are intended to reduce the costs of environmental review on lead agencies and project applicants by encouraging the use of existing environmental analysis where available. (Pub. Resources Code, § 21003(d) (use information in existing EIRs in order to reduce duplication), (f) (environmental review should proceed in the most efficient manner possible).)

ISSUES NOT ADDRESSED IN THE PROPOSED AMENDMENTS

Two issues raised during OPR's public outreach effort that are not addressed in the Proposed Amendments are discussed below.

"Climate Change"

Some comments submitted to OPR during its public workshops indicated that the Guidelines should be addressed to "Climate Change" rather than just the effects of GHG emissions. The focus in the Guidelines on GHG emissions is appropriate for at least three reasons.

First, the Legislative authorization for the Proposed Amendments refers specifically to guidelines on the "mitigation of greenhouse gas emissions and the effects of greenhouse gas emissions." (Pub. Resources Code, § 21083.05.) Had the Legislature intended the Guidelines to address climate change or global warming specifically, it presumably would have so indicated. Second, the precise "effect" of GHG emissions from a project is a factual matter for the lead agency to determine. Such effects may include "climate change," "global warming" and other changes in the physical environment (increased ocean acidity or sea-level rise, for example). (EPA, Draft Endangerment Finding, 74 Fed. Reg. 18886 (April 24, 2009), Technical Support Document, at pp. ES-2 to ES-3; see further discussion at pages 4-5, above.) Thus, rather than limit analysis to a particular effect, the proposed Guidelines on GHG emissions are consistent with the treatment of air pollutants in the existing Appendix G, which focus largely on the concentration of pollutants. (See, e.g., existing State CEQA Guidelines, Appendix G, III.d.) Third, the focus in a cumulative impacts analysis is "whether any additional effect caused by the proposed project should be considered significant given the existing cumulative effect." (*CBE*, *supra*, 103 Cal. App. 4th at 118.) Thus, the Proposed Amendments appropriately focus on a project's potential incremental contribution of GHGs rather than on the potential effect itself (i.e., climate change). Notably, however, the Proposed Amendments expressly incorporate the fair argument standard. (See, e.g., proposed Section 15064.4(b)(3).) Thus, if there is any substantial evidence supporting a fair argument that a project's GHG emissions may result in any adverse impacts, including climate change, the lead agency must resolve that concern in an EIR.

The Effects of Climate Change on the Project

Existing CEQA Guidelines and case law already address the potential need to analyze the effects of climate change on a project. Section 15126.2, for example, states:

> The EIR shall also analyze any significant environmental effects the project might cause by bringing development and people into the area affected. For example, an EIR on a subdivision astride an active fault line should identify as a significant effect the seismic hazard to future

> occupants of the subdivision. The subdivision would have the effect of attracting people to the location and exposing them to the hazards found there.

Any lead agency will have to respond to evidence that is placed before it prior to project approval, however. As explained above, where evidence indicates that a changing climate may ultimately result in adverse effects on the project, CEQA requires a lead agency to analyze that potential effect. (*Protect the Historic Amador Waterways v. Amador Water Agency, supra,* 116 Cal.App.4th at 1109 ("in preparing an EIR, the agency must consider and resolve every fair argument that can be made about the possible significant environmental effects of a project, irrespective of whether an established threshold of significance has been met with respect to any given effect").) Efforts are currently underway, for example, to develop regulatory guidance on adaptation strategies to protect against the effects of climate change. (See, e.g., Executive Order S-13-08 (requiring, among other things, the development of a state Climate Adaption Strategy).) Depending on the state of the science, however, a lead agency may appropriately conclude that such impacts are speculative, and end the discussion. (State CEQA Guidelines, § 15145.)

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Our Changing Climate

Assessing the Risks to California

A Summary Report from
the California Climate Change Center

Because most global warming emissions remain in the atmosphere for decades or centuries, the choices we make today greatly influence the climate our children and grandchildren inherit. The quality of life they experience will depend on if and how rapidly California and the rest of the world reduce these emissions.

In California and throughout western North America, signs of a changing climate are evident. During the last 50 years, winter and spring temperatures have been warmer, spring snow levels in lower- and mid-elevation mountains have dropped, snowpack has been melting one to four weeks earlier, and flowers are blooming one to two weeks earlier.



These regional changes are consistent with global trends. During the past 100 years, average temperatures have risen more than one degree Fahrenheit worldwide. Research indicates that much of this warming is due to human activities, primarily burning fossil fuels and clearing forests, that release carbon dioxide (CO_2) and other gases into the atmosphere, trapping in heat that would otherwise escape into space. Once in the atmosphere, these heat-trapping emissions remain there for many years—CO_2, for example, lasts about 100 years. As a result, atmospheric concentration of CO_2 has increased more than 30 percent above pre-industrial levels. If left unchecked, by the end of the century CO_2 concentrations could reach levels three times higher than pre-industrial times, leading to dangerous global warming that threatens our public health, economy, and environment.

The latest projections, based on state-of-the art climate models, indicate that if global heat-trapping emissions proceed at a medium to high rate, temperatures in California are expected to rise 4.7 to 10.5°F by the end of the century. In contrast, a lower emissions rate would keep the projected warming to 3 to 5.6°F. These temperature increases would have widespread consequences including substantial loss of snowpack, increased risk of large wildfires, and reductions in the quality and quantity of certain agricultural products. The state's vital resources and natural landscapes are already under increasing stress due to California's rapidly growing population, which is expected to grow from 35 million today to 55 million by 2050.

This document summarizes the recent findings of the California Climate Change Center's "Climate Scenarios" project, which analyzed a range of impacts that projected rising temperatures would likely have on California. The growing severity of the consequences as temperature rises underscores the importance of reducing emissions to minimize further warming. At the same time, it is essential to identify those consequences that may be unavoidable, for which we will need to develop coping and adaptation strategies.

In 2003, the California Energy Commission's Public Interest Energy Research (PIER) program established the California Climate Change Center to conduct climate change research relevant to the state. This Center is a virtual organization with core research activities at Scripps Institution of Oceanography and the University of California, Berkeley, complemented by efforts at other research institutions. Priority research areas defined in PIER's five-year Climate Change Research Plan are: monitoring, analysis, and modeling of climate; analysis of options to reduce greenhouse gas emissions; assessment of physical impacts and of adaptation strategies; and analysis of the economic consequences of both climate change impacts as well as the efforts designed to reduce emissions.

Executive Order #S-3-05, signed by Governor Arnold Schwarzenegger on June 1, 2005, called for the California Environmental Protection Agency (CalEPA) to prepare biennial science reports on the potential impact of continued global warming on certain sectors of the California economy. CalEPA entrusted PIER and its California Climate Change Center to lead this effort. The "Climate Scenarios" analysis summarized here is the first of these biennial science reports, and is the product of a multi-institution collaboration among the California Air Resources Board, California Department of Water Resources, California Energy Commission, CalEPA, and the Union of Concerned Scientists.

Cover photos: (sunset) Photos.com; (from top to bottom) AP Photo/Paul Sakuma, iStockphoto, IndexStock, Picturequest, iStockphoto. Above: Bureau of Land Management. Background: IndexStock

California's Future Climate

California's climate is expected to become considerably warmer during this century. How much warmer depends on the rate at which human activities, such as the burning of fossil fuels, continue. The projections presented here illustrate the climatic changes that are likely from three different heat-trapping emissions scenarios (see figure below).

Projected Warming

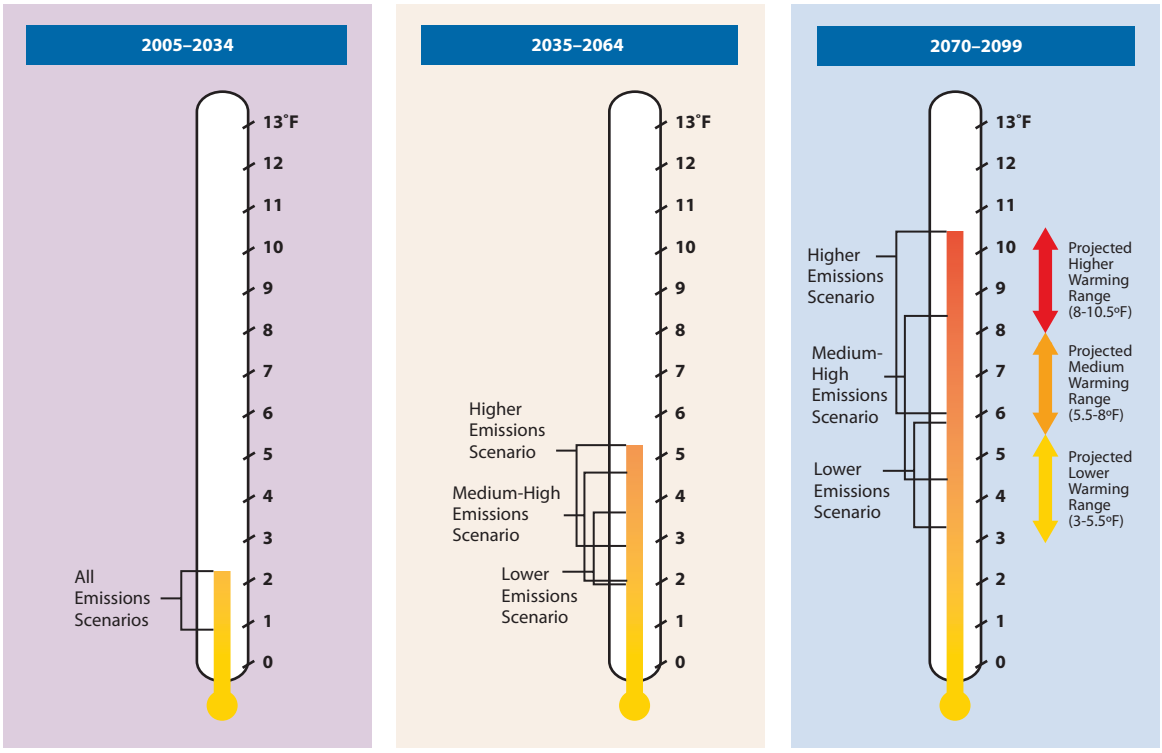
Temperatures are expected to rise substantially in all three emissions scenarios. During the next few decades, the three scenarios project average temperatures to rise between 1 and 2.3°F; however, the projected temperature increases begin to diverge at mid-century so that, by the end of the century, the temperature increases projected in the higher emissions scenario are approximately twice as high as those projected in the lower emissions scenario. Some climate models indicate that warming would be greater in summer than in winter, which would have widespread effects on ecosystem health, agricultural production, water use and availability, and energy demand.

Toward the end of the century, depending on future heat-trapping emissions, statewide average temperatures are expected to rise between 3 and 10.5°F. The analysis presented here examines the future climate under three projected warming ranges:[1]

- **Lower warming range:** projected temperature rises between 3 and 5.5°F
- **Medium warming range:** projected temperature rises between 5.5 and 8°F
- **Higher warming range:** projected temperature rises between 8 and 10.5°F

Precipitation

On average, the projections show little change in total annual precipitation in California. Furthermore, among several models, precipitation projections do not show a consistent trend during the next century. The Mediterranean seasonal precipitation pattern is expected to continue, with most precipitation falling during winter from North Pacific storms. One of the three climate models projects slightly wetter winters, and another projects slightly drier winters with a 10 to 20 percent decrease in total annual precipitation. However, even modest changes would have a significant impact because California ecosystems are conditioned to historical precipitation levels and water resources are nearly fully utilized.



California is expected to experience dramatically warmer temperatures during the 21st century. This figure shows projected increases in statewide annual temperatures for three 30-year periods. Ranges for each emissions scenario represent results from state-of-the-art climate models.

1 These warming ranges are for illustrative purposes only. These ranges were defined in the original Climate Scenarios analysis to capture the full range of projected temperature rise. The exact values for the warming ranges as presented in the original summary report are: lower warming range (3 to 5.4°F); medium warming range (5.5 to 7.9°F); and higher warming range (8 to 10.4°F).

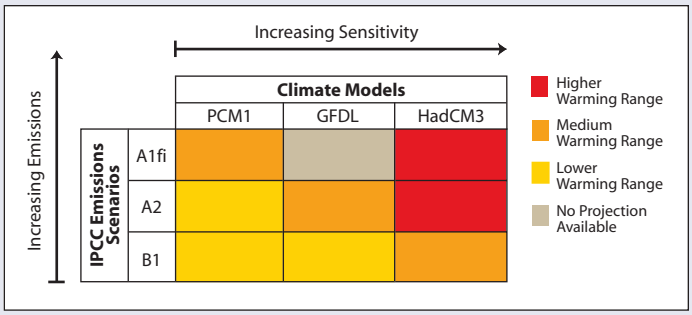
Projecting Future Climate

How much temperatures rise depends in large part on how much and how quickly heat-trapping emissions accumulate in the atmosphere and how the climate responds to these emissions. The projections presented in this report are based on three different heat-trapping emissions scenarios and three climate models.

Emissions Scenarios

The three global emissions scenarios used in this analysis were selected from a set of scenarios developed by the Intergovernmental Panel on Climate Change's (IPCC) *Special Report on Emissions Scenarios*, based on different assumptions about population growth and economic development (measured in gross domestic product).

- The **lower emissions scenario (B1)** characterizes a world with high economic growth and a global population that peaks by mid-century and then declines. There is a rapid shift toward less fossil fuel-intensive industries and introduction of clean and resource-efficient technologies. Heat-trapping emissions peak about mid-century and then decline; CO_2 concentration approximately doubles, relative to pre-industrial levels, by 2100.
- The **medium-high emissions scenario (A2)** projects continuous population growth and uneven economic and technological growth. The income gap between now-industrialized and developing parts of the world does not narrow. Heat-trapping emissions increase through the 21st century; atmospheric CO_2 concentration approximately triples, relative to pre-industrial levels, by 2100.
- The **higher emissions scenario (A1fi)** represents a world with high fossil fuel-intensive economic growth, and a global population that peaks mid-century then declines. New and more efficient technologies are introduced toward the end of the century. Heat-trapping emissions increase through the 21st century; CO_2 concentration more than triples, relative to pre-industrial levels, by 2100.



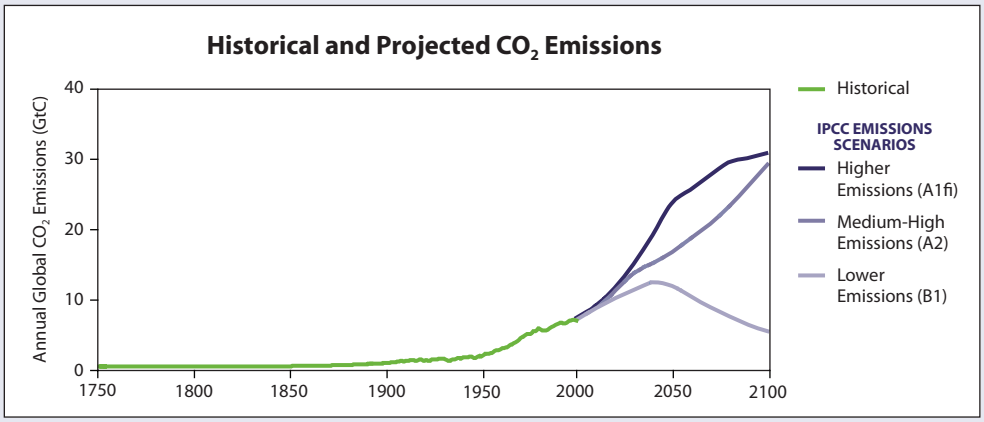
This matrix shows the temperature increases that result from the three climate models, assuming emission inputs indicated in the IPCC emissions scenarios. The resulting temperatures are grouped into three warming ranges defined in the "Climate Scenarios" analysis.

Climate Sensitivity

The three models used in this analysis represent different climate sensitivities, or the extent to which temperatures will rise as a result of increasing atmospheric concentrations of heat-trapping gases. Climate sensitivity depends on Earth's response to certain physical processes, including a number of "feedbacks" that might amplify or lessen warming. For example, as heat-trapping emissions cause temperatures to rise, the atmosphere can hold more water vapor, which traps heat and raises temperatures further—a positive feedback. Clouds created by this water vapor could absorb and re-radiate outgoing infrared radiation from Earth's surface (another positive feedback) or reflect more incoming shortwave radiation from the sun before it reaches Earth's surface (a negative feedback).

Because many of these processes and their feedbacks are not yet fully understood, they are represented somewhat differently in different global climate models. The three global climate models used in this analysis are:

- **National Center for Atmospheric Research Parallel Climate Model (PCM1):** low climate sensitivity
- **Geophysical Fluids Dynamic Laboratory (GFDL) CM2.1:** medium climate sensitivity
- **United Kingdom Met Office Hadley Centre Climate Model, version 3 (HadCM3):** medium-high climate sensitivity



As this figure shows, CO_2 emissions from human activities (such as the burning of fossil fuels) were negligible until around the so-called industrial age starting in the 1850s.



Public Health

Continued global warming will affect Californians' health by exacerbating air pollution, intensifying heat waves, and expanding the range of infectious diseases. The primary concern is not so much the change in *average* climate but the projected increase in *extreme* conditions, which pose the most serious health risks.

Poor Air Quality Made Worse

Californians currently experience the worst air quality in the nation, with more than 90 percent of the population living in areas that violate the state's air quality standard for either ground-level ozone or airborne particulate matter. These pollutants can cause or aggravate a wide range of health problems including asthma and other acute respiratory and cardiovascular diseases, and can decrease lung function in children. Combined, ozone and particulate matter contribute to 8,800 deaths and $71 billion in healthcare costs every year. If global background ozone levels increase as projected in some scenarios, it may become impossible to meet local air quality standards.

Higher temperatures are expected to increase the frequency, duration, and intensity of conditions conducive to air pollution formation. For example, if temperatures rise to the medium warming range, there will be 75 to 85 percent more days with weather conducive to ozone formation in Los Angeles and the San Joaquin Valley, relative to today's conditions. This is more than twice the increase expected if temperature rises are kept in the lower warming range.

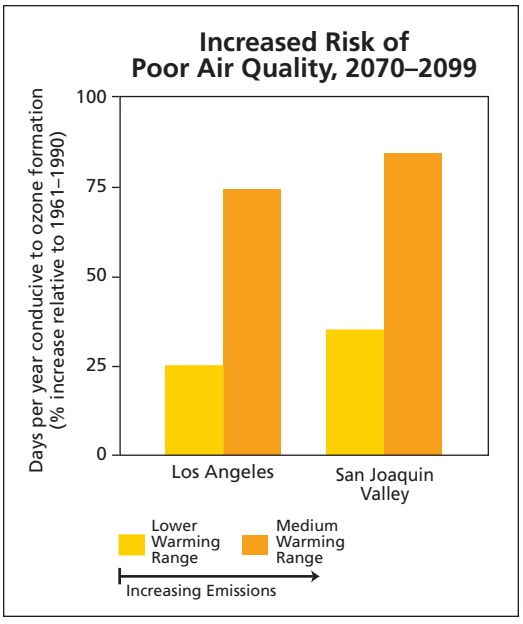
Air quality could be further compromised by increases in wildfires, which emit fine particulate matter that can travel long distances depending on wind conditions. The most recent analysis suggests that if heat-trapping gas emissions are not significantly reduced, large wildfires could become up to 55 percent more frequent toward the end of the century.

More Severe Heat

By 2100, if temperatures rise to the higher warming range, there could be up to 100 more days per year with temperatures above 90°F in Los Angeles and above 95°F in Sacramento. This is a striking increase over historical patterns (see chart on p. 6), and almost twice the increase projected if temperatures remain within or below the lower warming range.

As temperatures rise, Californians will face greater risk of death from dehydration, heat stroke/exhaustion, heart attack, stroke, and respiratory distress caused by extreme heat. By mid century, extreme heat events in urban centers such as Sacramento, Los Angeles, and San Bernardino could cause two to three times more heat-related deaths than occur today. The members of the population most vulnerable to the effects of extreme heat include people who are already ill; children; the elderly;

As temperatures rise, Californians will face greater risk of death from dehydration, heat stroke, heart attack, and other heat-related illnesses.

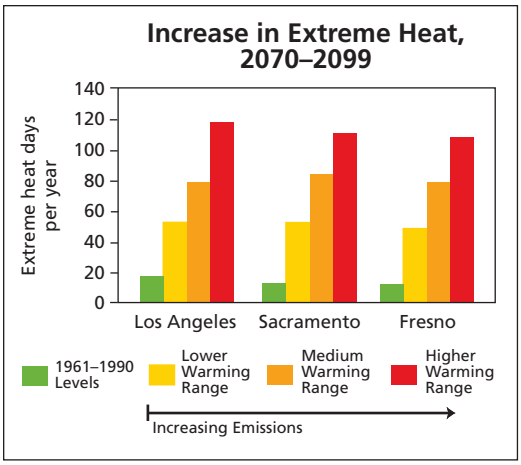




Cars and power plants emit pollutants that contribute to global warming and poor air quality. As temperatures increase, it will be increasingly difficult to meet air quality standards throughout the state.

and the poor, who may lack access to air conditioning and medical assistance.

More research is needed to better understand the potential effects of higher temperatures and the role that adaptation can play in minimizing these effects. For example, expanding air conditioner use can help people cope with extreme heat; however, it also increases energy consumption, which, using today's fossil fuel-heavy energy sources, would contribute to further global warming and air pollution.





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Water Resources



If global warming emissions continue unabated, Sierra Nevada snowpack could decline 70 to 90 percent, with cascading effects on winter recreation, water supply, and natural ecosystems.

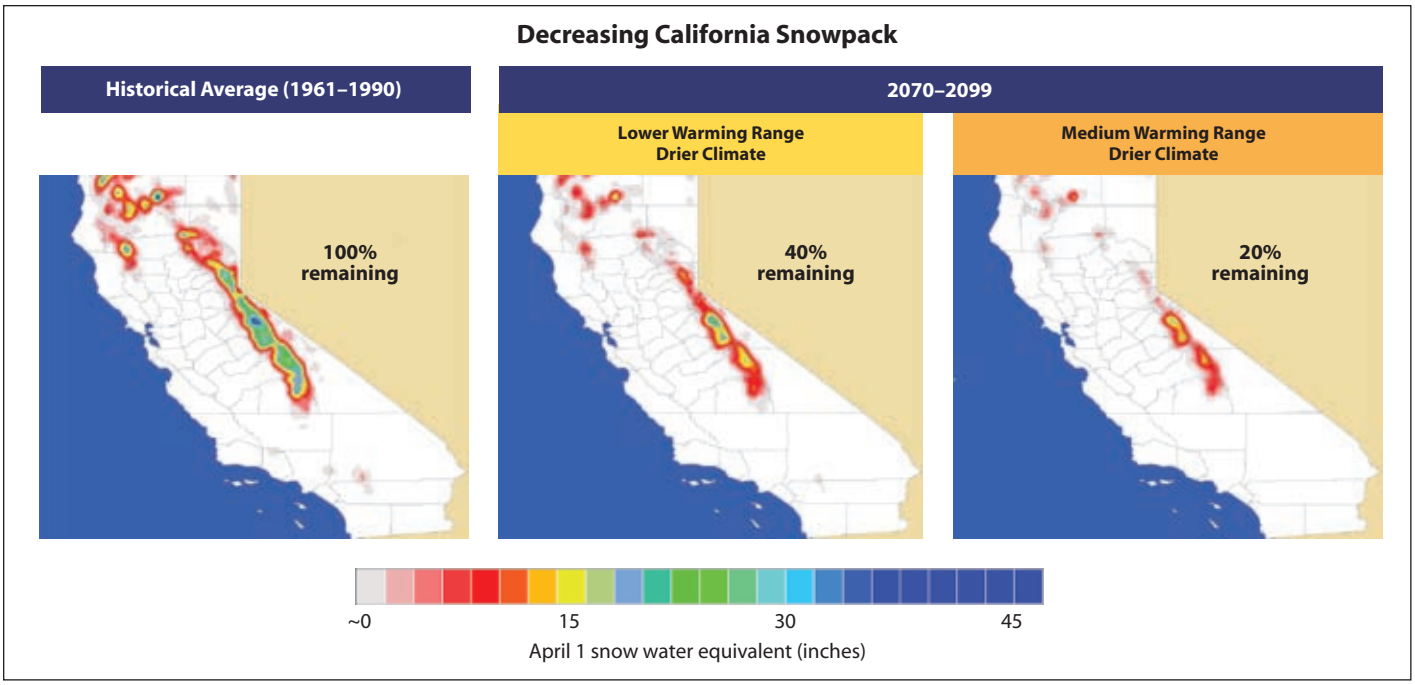
Most of California's precipitation falls in the northern part of the state during the winter while the greatest demand for water comes from users in the southern part of the state during the spring and summer. A vast network of man-made reservoirs and aqueducts capture and transport water throughout the state from northern California rivers and the Colorado River. The current distribution system relies on Sierra Nevada mountain snowpack to supply water during the dry spring and summer months. Rising temperatures, potentially compounded by decreases in precipitation, could severely reduce spring snowpack, increasing the risk of summer water shortages.

Decreasing Sierra Nevada Snowpack

If heat-trapping emissions continue unabated, more precipitation will fall as rain instead of snow, and the snow that does fall will melt earlier, reducing the Sierra Nevada spring snowpack by as much as 70 to 90 percent. How much snowpack will be lost depends in part on future precipitation patterns, the projections for which remain uncertain. However, even under wetter climate projections, the loss of snowpack would pose challenges to water managers, hamper hydropower generation, and nearly eliminate skiing and other snow-related recreational activities. If global warming emissions are significantly curbed and temperature increases are kept in the lower warming range, snowpack losses are expected to be only half as large as those expected if temperatures were to rise to the higher warming range.

Challenges in Securing Adequate Water Supplies

Continued global warming will increase pressure on California's water resources, which are already over-stretched by the demands of a growing



economy and population. Decreasing snowmelt and spring stream flows coupled with increasing demand for water resulting from both a growing population and hotter climate could lead to increasing water shortages. By the end of the century, if temperatures rise to the medium warming range and precipitation decreases, late spring stream flow could decline by up to 30 percent. Agricultural areas could be hard hit, with California farmers losing as much as 25 percent of the water supply they need.

Water supplies are also at risk from rising sea levels. An influx of saltwater would degrade California's estuaries, wetlands, and groundwater aquifers. In particular, saltwater intrusion would threaten the quality and reliability of the major state fresh water supply that is pumped from the southern edge of the Sacramento/San Joaquin River Delta.

Coping with the most severe consequences of global warming would require major changes in water management and allocation systems. As more winter precipitation falls as rain instead of snow, water managers will have to balance the need to fill constructed reservoirs for water supply and the need to maintain reservoir space for winter flood control. Some additional storage could be developed; however, the economic and environmental costs would be high.



Left: Photodisc. Right: Corbis

Rising temperatures, potentially exacerbated by decreasing precipitation, could increase the risk of water shortages in urban and agricultural sectors.

Potential Reduction in Hydropower

Higher temperatures will likely increase electricity demand due to higher air conditioning use. Even if the population remained unchanged, toward the end of the century annual electricity demand could increase by as much as 20 percent if temperatures rise into the higher warming range. (Implementing aggressive efficiency measures could lower this estimate.)

At the same time, diminished snow melt flowing through dams will decrease the potential for hydropower production, which now comprises about 15 percent of California's in-state electricity production. If temperatures rise to the medium warming range and precipitation decreases by 10 to 20 percent, hydropower production may be reduced by up to 30 percent. However, future precipitation projections are quite uncertain so it is possible that precipitation may increase and expand hydropower generation.

Loss of Winter Recreation

Continued global warming will have widespread implications for winter tourism. Declines in Sierra Nevada snowpack would lead to later starting and earlier closing dates of the ski season. Toward the end of the century, if temperatures rise to the lower warming range, the ski season at lower and middle elevations could shorten by as much as a month. If temperatures reach the higher warming range and precipitation declines, there might be many years with insufficient snow for skiing and snowboarding.



Stephen McMillan

Agriculture

California is home to a $30 billion agriculture industry that employs more than one million workers. It is the largest and most diverse agriculture industry in the nation, producing more than 300 commodities including half the country's fruits and vegetables. Increased heat-trapping emissions are expected to cause widespread changes to this industry, reducing the quantity and quality of agricultural products statewide.

Although higher carbon dioxide levels can stimulate plant production and increase plant water-use efficiency, California farmers will face greater water demand for crops and a less reliable water supply as temperatures rise. Crop growth and development will change, as will the intensity and frequency of pest and disease outbreaks. Rising temperatures will likely aggravate ozone pollution, which makes plants more susceptible to disease and pests and interferes with plant growth.

To prepare for these changes, and to adapt to changes already under way, major efforts will be needed to move crops to new locations, respond to climate variability, and develop new cultivars and agricultural technologies. With adequate research and advance preparation, some of the consequences could be reduced.

Increasing Temperature

Plant growth tends to be slow at low temperatures, increasing with rising temperatures up to a threshold. However, faster growth can result in less-than-optimal development for many crops, so rising temperatures are likely to worsen the quantity and quality of yield for a number of California's agricultural products. Crops that are likely to be hard hit include:

Wine Grapes

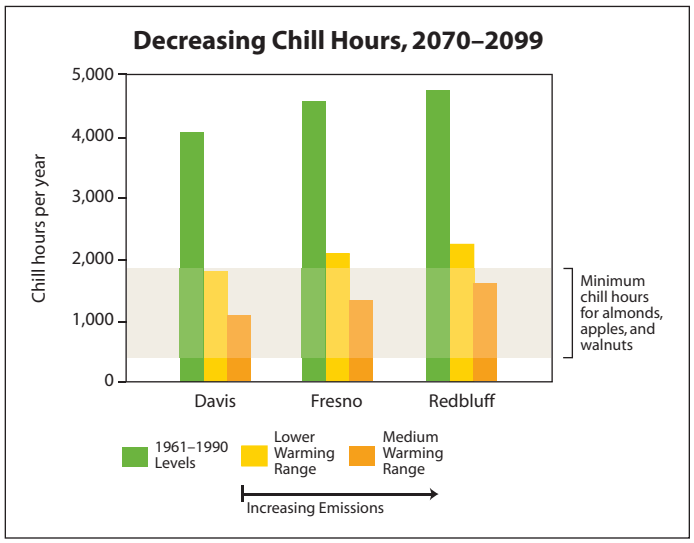
California is the nation's largest wine producer and the fourth-largest wine producer worldwide. High-quality wines produced throughout the Napa and Sonoma Valleys and along the northern and central coasts generate $3.2 billion in revenue each year. High temperatures during the growing season can cause premature ripening and reduce grape quality. Temperature increases are expected to have only modest effect on grape quality in most regions over the next few decades. However, toward the end of the century, wine grapes could ripen as much as one to two months earlier, which will affect grape quality in all but the coolest coastal locations (Mendocino and Monterey Counties).



IndexOpen

Fruits and Nuts

Many fruit and nut trees are particularly sensitive to temperature changes because of heat-accumulation limits and chill-hour requirements. Heat accumulation, which refers to the total hours during which temperatures reach between 45 and 95°F, is critical for fruit development. Rising temperatures could increase fruit development rates and decrease fruit size.



For example, peaches and nectarines developed and were harvested early in 2004 because of warm spring temperatures. The fruits were smaller than normal, which placed them in a lower quality category.

A minimum number of chill hours (hours during which temperatures drop below 45°F) is required for proper bud setting; too few hours can cause late or irregular bloom, decreasing fruit quality and subsequent marketable yield. California is currently classified as a moderate to high chill-hour region, but chill hours are diminishing in many areas of the state. If temperatures rise to the medium warming range, the number of chill hours in the entire Central Valley is expected to approach a critical threshold for some fruit trees.

Milk

California's $3 billion dairy industry supplies nearly one-fifth of the nation's milk products. High temperatures can stress dairy cows, reducing milk production. Production begins to decline at temperatures as low as 77°F and can drop substantially as temperatures climb above 90°F. Toward the end of the century, if temperatures rise to the higher warming range, milk production is expected to decrease by up to 20 percent. This is more

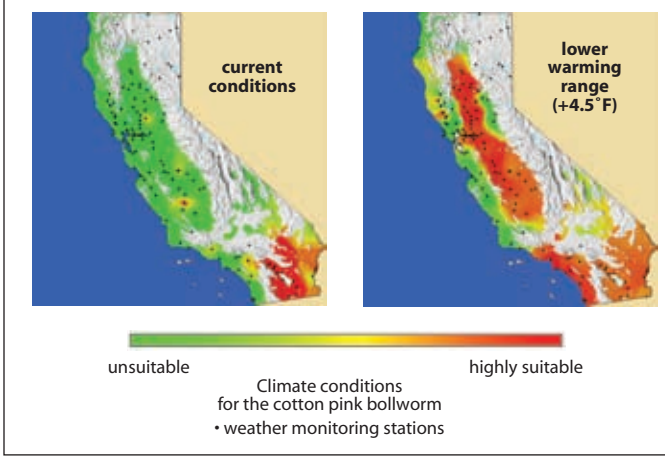


Increasing temperatures will likely decrease the quantity and quality of some agricultural commodities, such as certain varieties of fruit trees, wine grapes, and dairy products.

than twice the reduction expected if temperatures stay within or below the lower warming range.

Expanding Ranges of Agricultural Weeds

Noxious and invasive weeds currently infest more than 20 million acres of California farmland, costing hundreds of millions of dollars annually in control measures and lost productivity. Continued climate change will likely shift the ranges of existing invasive plants and weeds and alter competition patterns with native plants. Range expansion is expected in many species while range contractions are less likely in rapidly evolving species with significant populations already established. Should range contractions occur, it is likely that new or different weed species will fill the emerging gaps.



Increasing Threats from Pests and Pathogens

California farmers contend with a wide range of crop-damaging pests and pathogens. Continued climate change is likely to alter the abundance and types of many pests, lengthen pests' breeding season, and increase pathogen growth rates. For example, the pink bollworm, a common pest of cotton crops, is currently a problem only in southern desert valleys because it cannot survive winter frosts elsewhere in the state. However, if winter temperatures rise 3 to 4.5°F, the pink bollworm's range would likely expand northward, which could lead to substantial economic and ecological consequences for the state.

Temperature is not the only climatic influence on pests. For example, some insects are unable to cope in extreme drought, while others cannot survive in extremely wet conditions. Furthermore, while warming speeds up the lifecycles of many insects, suggesting that pest problems could increase, some insects may grow more slowly as elevated CO_2 levels decrease the protein content of the leaves on which they feed.

Multiple and Interacting Stresses

Although the effects on specific crops of individual factors (e.g., temperatures, pests, water supply) are increasingly well understood, trying to quantify interactions among these and other environmental factors is challenging. For example, the quality of certain grape varieties is expected to decline as temperatures rise. But the wine-grape industry also faces increasing risks from pests such as the glassy-winged sharpshooter, which transmits Pierce's disease. In 2002, this bacterial disease caused damage worth $13 million in Riverside County alone. The optimum temperature for growth of Pierce's disease is 82°F, so this disease is currently uncommon in the cooler northern and coastal regions of the state. However, with continued warming, these regions may face increased risk of the glassy-winged sharpshooter feeding on leaves and transmitting Pierce's disease.



U.S. Dept. of Agriculture

As temperatures rise, the climate is expected to become more favorable for the pink bollworm (above), a major cotton pest in southern California. The pink bollworm's geographic range is limited by winter frosts that kill over-wintering dormant larvae. As temperatures rise, winter frosts will decrease, greatly increasing the winter survival and subsequent spread of the pest throughout the state.



Forests and Landscapes

California is one of the most climatically and biologically diverse areas in the world, supporting thousands of plant and animal species. The state's burgeoning population and consequent impact on local landscapes is threatening much of this biological wealth. Global warming is expected to intensify this threat by increasing the risk of wildfire and altering the distribution and character of natural vegetation.

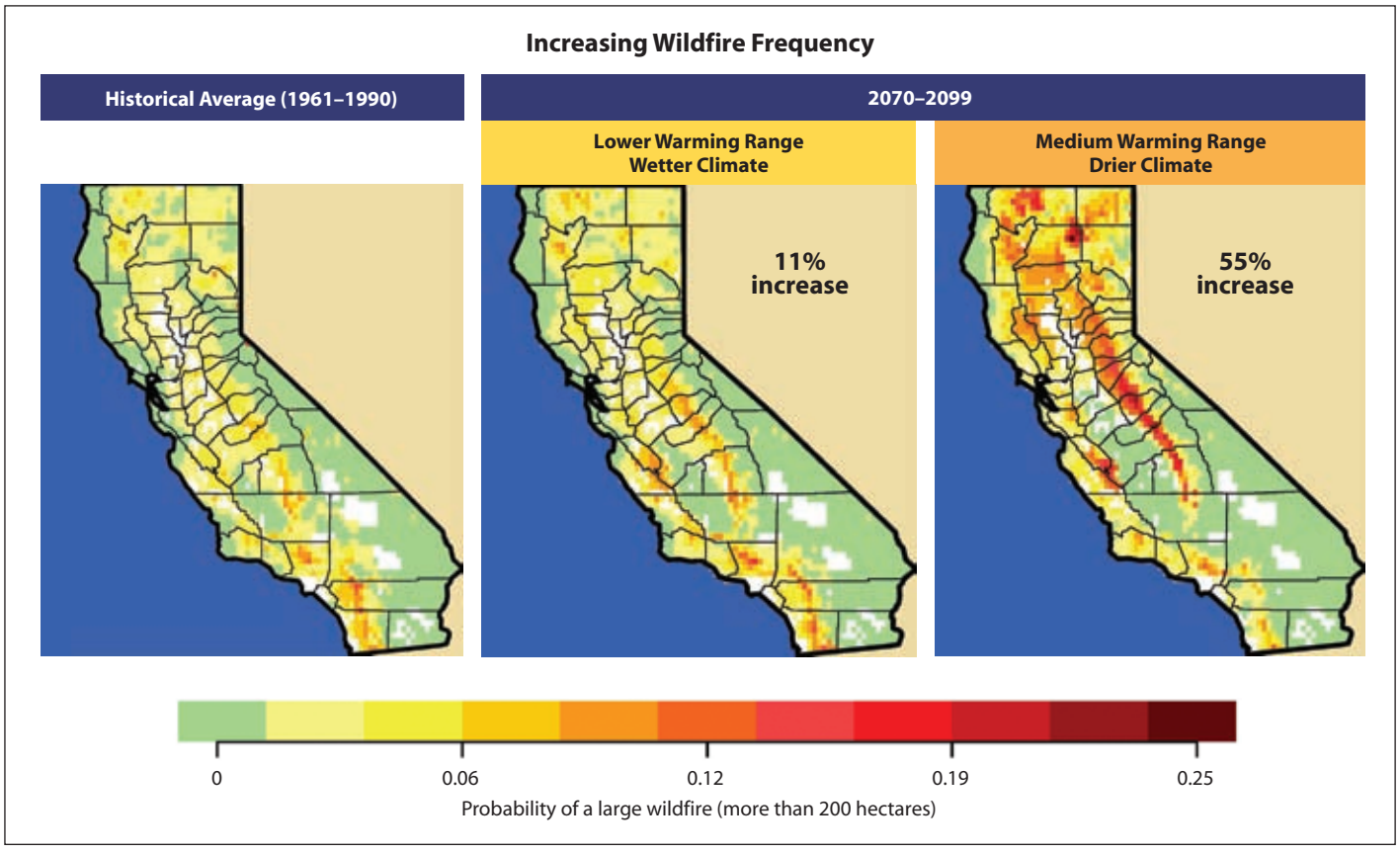
Increasing Wildfires

Fire is an important ecosystem disturbance. It promotes vegetation and wildlife diversity, releases nutrients into the soil, and eliminates heavy accumulation of underbrush that can fuel catastrophic fires. However, if temperatures rise into the medium warming range, the risk of large wildfires in California could increase by as much as 55 percent, which is almost twice the increase expected if temperatures stay in the lower warming range.

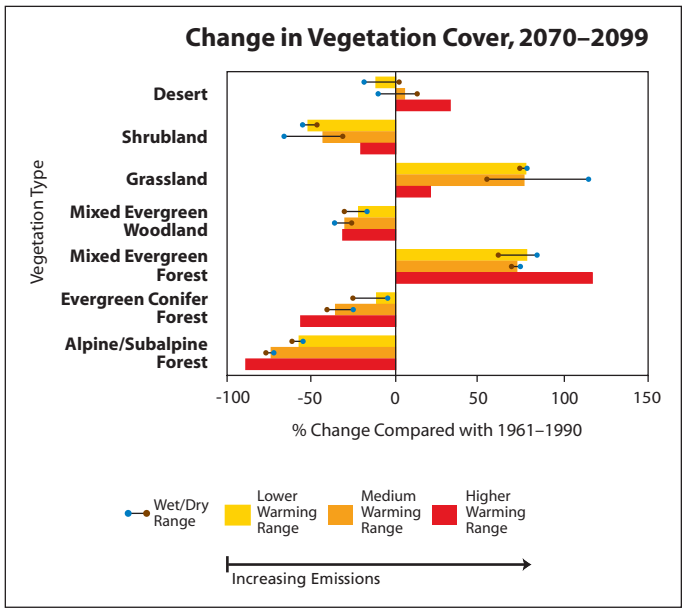
Because wildfire risk is determined by a combination of factors including precipitation, winds, temperature, and landscape and vegetation conditions, future risks will not be uniform throughout the state. In many regions, wildfire activity will depend critically on future precipitation patterns. For

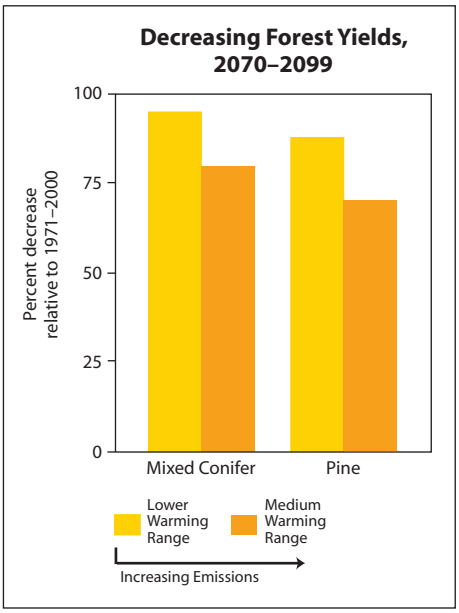


Global warming threatens alpine and subalpine ecosystems, which have no place to move as temperatures rise.



Vegetation cover over the 21st century will depend on both temperature and precipitation. The lower and medium warming range bars reflect vegetation cover under a wetter climate (blue) and a drier climate (brown) projected in the different climate models. For the higher warming range, only a drier climate was considered.





example, if precipitation increases as temperatures rise, wildfires in the grasslands and chaparral ecosystems of southern California are expected to increase by approximately 30 percent toward the end of the century because more winter rain will stimulate the growth of more plant "fuel" available to burn in the fall. In contrast, a hotter, drier climate could promote up to 90 percent more northern California fires by the end of the century by drying out and increasing the flammability of forest vegetation.

Shifting Vegetation

Land use and other changes resulting from economic development are altering natural habitats throughout the state. Continued global warming will intensify these pressures on the state's natural ecosystems and biological diversity. For example, in northern California, warmer temperatures are expected to shift dominant forest species from Douglas and White Fir to madrone and oaks. In inland regions, increases in fire frequency are expected to promote expansion of grasslands into current shrub and woodland areas. Alpine and subalpine ecosystems are among the most threatened in the state; plants suited to these regions have limited opportunity to migrate "up slope" and are expected to decline by as much as 60 to 80 percent by the end of the century as a result of increasing temperatures.

Declining Forest Productivity

Forestlands cover 45 percent of the state; 35 percent of this is commercial forests such as pine plantations. Recent projections suggest that continued global warming could adversely affect the health and productivity of California's forests. If average statewide temperatures rise to the medium warming range, the productivity of mixed conifer forests is expected to diminish by as much as 18 percent by the end of the century. Yield reductions from pine plantations are expected to be even more severe, with up to a 30 percent decrease by the end of the century.

The risk of large wildfires in California could increase by as much as 55 percent.



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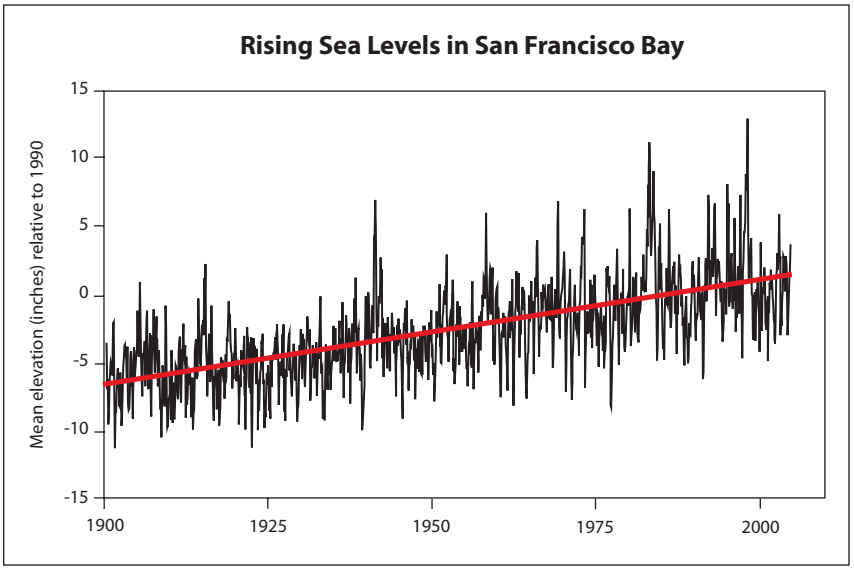
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Rising Sea Levels

California's 1,100 miles of coastline are a major attraction for tourism, recreation, and other economic activity. The coast is also home to unique ecosystems that are among the world's most imperiled. As global warming continues, California's coastal regions will be increasingly threatened by rising sea levels, more intense coastal storms, and warmer water temperatures.

During the past century, sea levels along California's coast have risen about seven inches. If heat-trapping emissions continue unabated and temperatures rise into the higher warming range, sea level is expected to rise an additional 22 to 35 inches by the end of the century. Elevations of this magnitude would inundate coastal areas with salt water, accelerate coastal erosion, threaten vital levees and inland water systems, and disrupt wetlands and natural habitats.



Increasing Coastal Floods

The combination of increasingly severe winter storms, rising mean sea levels, and high tides is expected to cause more frequent and severe flooding, erosion, and damage to coastal structures. Many California coastal areas are at significant risk for flood damage. For example, the city of Santa Cruz is built on the 100-year floodplain and is only 20 feet above sea level. Although levees have been built to contain the 100-year flood, a 12-inch increase in sea levels (projected for the medium warming range of temperatures) would mean storm-surge-induced flood events at the 100-year level would likely occur once every 10 years.

Flooding can create significant damage and enormous financial losses. Despite extensive engineering efforts, major floods have repeatedly breached levees that protect freshwater supplies and islands in the San Francisco Bay Delta as well as fragile marine estuaries and wetlands throughout the



Robert A. Eplett/CA Governor's Office of Emergency Services

Rising sea levels and more intense storm surges could increase the risk for coastal flooding.

Sea levels could rise up to three feet by the end of the century, accelerating coastal erosion, threating vital levees, and disrupting wetlands.

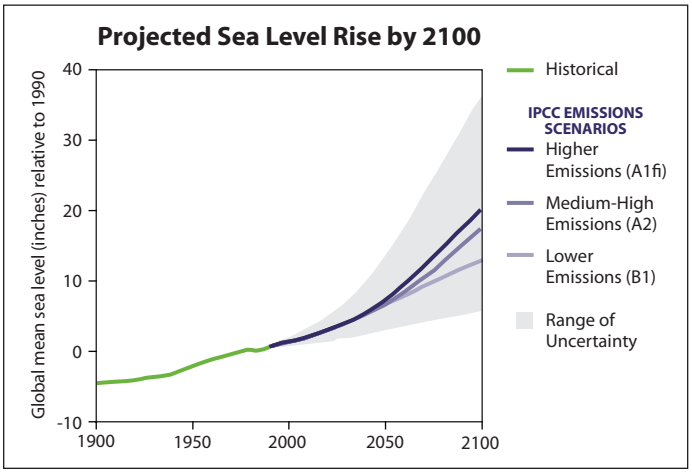
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Many California beaches are threatened from rising sea levels and increased erosion, an expected consequence of continued global warming.

state. Continued sea level rise will further increase vulnerability to levee failures. Some of the most extreme flooding during the past few decades has occurred during El Niño winters, when warmer waters fuel more intense storms. During the winters of 1982–1983 and 1997–1998, for example, abnormally high seas and storm surges caused millions of dollars' worth of damage in the San Francisco Bay area. Highways were flooded as six-foot waves crashed over waterfront bulkheads, and valuable coastal real estate was destroyed.

Continued global warming will require major changes in flood management. In many regions such as the Central Valley, where urbanization and limited river channel capacity already exacerbate rising flood risks, flood damage and flood control costs could amount to several billion dollars.



Shrinking Beaches

Many of California's beaches may shrink in the future because of rising seas and increased erosion from winter storms. Currently, many beaches are protected from erosion through manmade sand replenishment (or "nourishment") programs, which bring in sand from outside sources to replace the diminishing supply of natural sand. In fact, many of the wide sandy beaches in southern California around Santa Monica, Venice, and Newport Beach were created and are maintained entirely by sand nourishment programs. As sea levels rise, increasing volumes of replacement sand will be needed to maintain current beach width and quality. California beach nourishment programs currently cost millions of dollars each year. As global warming continues, the costs of beach nourishment programs will rise, and in some regions beach replenishment may no longer be viable.

Multiple Causes of Coastal Flooding

Several factors play a role in sea level and coastal flooding, including tides, waves temperature, and storm activity. Sea levels fluctuate daily, monthly, and seasonally; the highest tides occur in winter and in summer, during new and full moons. Sea levels often rise even higher during El Niño winters, when the Eastern Pacific Ocean is warmer than usual and westerly wind patterns are strengthened.

Coastal flooding usually occurs during winter storms, which bring strong winds and high waves. Storm winds tend to raise water levels along the coast and produce high waves at the same time, compounding the risk of damaging waves—a doubling of wave height is equivalent to a four-fold increase in wave energy. When these factors coincide with high tides, the chances for coastal damage are greatly heightened.

As sea levels rise, flood stages in the Sacramento/San Joaquin Delta of the San Francisco Bay estuary may also rise, putting increasing pressure on Delta levees. This threat may be particularly significant because recent estimates indicate the additional force exerted upon the levees is equivalent to the square of the water level rise. Estimates using historical observations and climate model projections suggest that extreme high water levels in the Bay and Delta will increase markedly if sea level rises above its historical rate. These extremes are most likely to occur during storm events, leading to more severe damage from waves and floods.

Top left & right: Photos.com. Bottom: CA Fuel Cell Partnership







Cleaner energy and vehicle technologies can help California reduce global warming emissions, improve air quality, and protect public health.

Managing Global Warming

Continued global warming will have widespread and significant impacts on the Golden State. Solutions are available today to reduce emissions and minimize these impacts.

The projections presented in this analysis suggest that many of the most severe consequences that are expected from the medium and higher warming ranges could be avoided if heat-trapping emissions can be reduced to levels that will hold temperature increases at or below the lower warming range (i.e., an increase of no more than 5.5°F). However, even if emissions are substantially reduced, research indicates that some climatic changes are unavoidable. Although not the solution to global warming, plans to cope with these changes are essential.

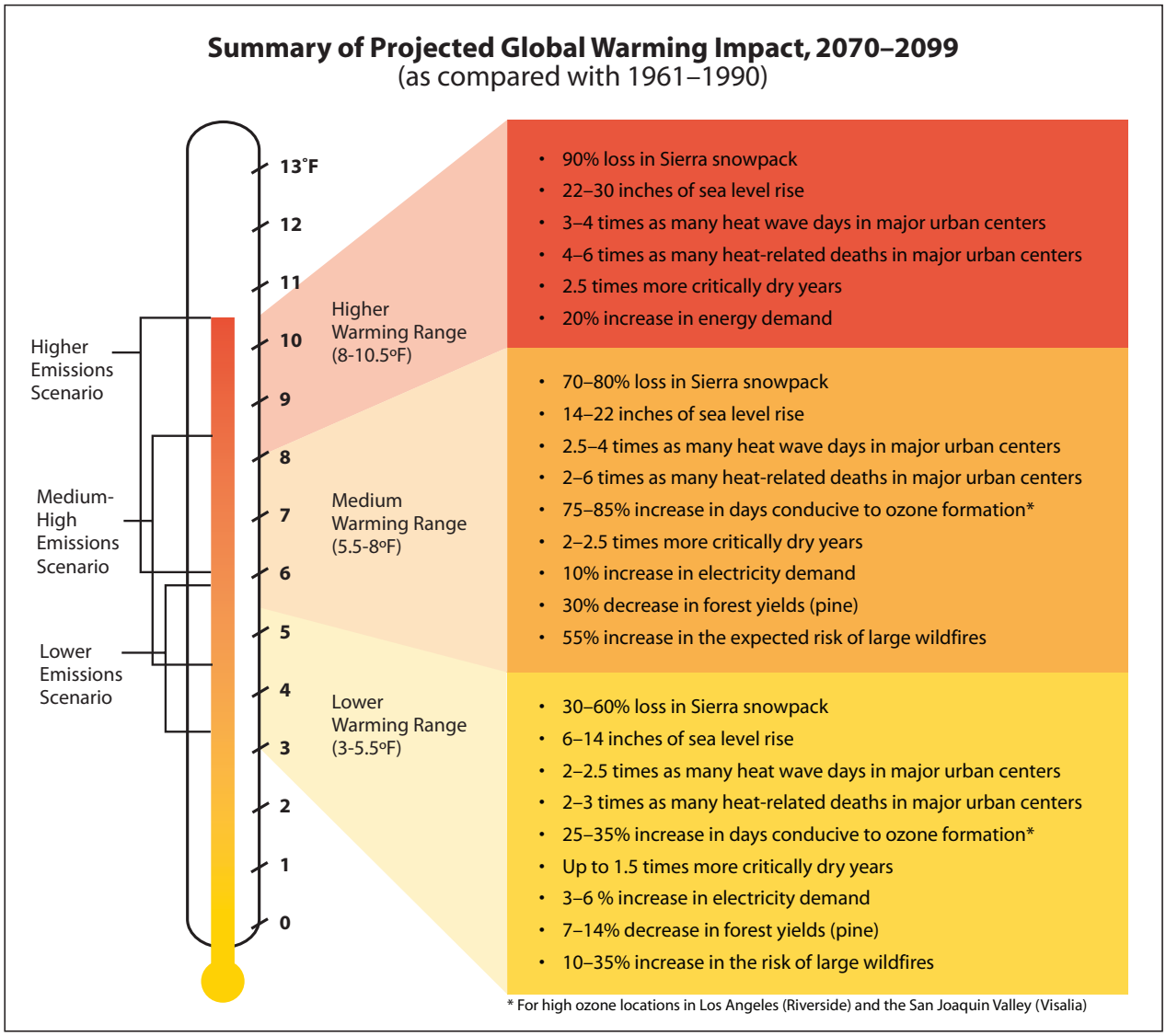
California's actions can drive global progress to address global warming.

Reducing Heat-Trapping Emissions

Reducing heat-trapping emissions is the most important way to slow the rate of global warming. On June 1, 2005, Governor Arnold Schwarzenegger signed an executive order (#S-3-05) that sets goals for significantly lowering the state's share of global warming pollution. The executive order calls for a reduction in heat-trapping emissions to 1990 levels by 2020 and for an 80 percent emissions reduction below 1990 levels by 2050. These emission reduction targets will help stimulate technological innovation needed to help transition to more efficient and renewable transportation and energy systems.

Coping with Unavoidable Climatic Changes

Because global warming is already upon us, and some amount of additional warming is inevitable, we must prepare for the changes that are already under way.



Preparing for these unavoidable changes will require minimizing further stresses on sensitive ecosystems and implementing management practices that integrate climate risks into long-term planning strategies.

California's Leadership

California has been a leader in both the science of climate change and in identifying solutions. The California Climate Change Center is one of the first—and perhaps the only—state-sponsored research institution in the nation dedicated to climate change research, and other state agencies such as the Air Resources Board support similar research. Continuing this strong research agenda is critical for developing effective strategies for addressing global warming in California.

The state has also been at the forefront of efforts to reduce heat-trapping emissions, passing precedent-setting policies such as aggressive standards for tailpipe emissions, renewable energy, and energy efficiency. However, existing policies are not likely to be sufficient to meet the ambitious emission reduction goals set by the governor. To meet these ambitious goals California will need to build on its legacy of environmental leadership and develop new strategies and technologies to reduce emissions.

By reducing heat-trapping emissions, severe consequences can be avoided.

California alone cannot stabilize the climate. However, the state's actions can drive global progress. If the industrialized world were to follow the emission reduction targets established in California's executive order, and industrializing nations reduced emissions according to the lower emissions path (B1) presented in this analysis, we would be on track to keep temperatures from rising to the medium or higher (and possibly even the lower) warming ranges and thus avoid the most severe consequences of global warming.

The full text of the Climate Scenarios analysis overview report, and the core scientific papers that comprise this analysis, are online at *www.climatechange.ca.gov*. The scientists that participated in this effort are:

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Reducing Greenhouse Gases from Electricity and Natural Gas Use in San Diego County Buildings

An Analysis of Local Government Policy Options

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October 2009



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About EPIC

The Energy Policy Initiatives Center (EPIC) is a nonprofit academic and research center of the USD School of Law that studies energy policy issues affecting the San Diego region and California. EPIC integrates research and analysis, law school study, public education, and serves as a source of legal and policy expertise and information in the development of sustainable solutions that meet our future energy needs.

For more information, please visit the EPIC Web site at www.sandiego.edu/epic.



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1. INTRODUCTION

Reducing greenhouse gases (GHG) to sustainable levels will require action from international, federal, state, and local governments and organizations. Each level of government has specific jurisdiction and potential to affect emissions levels. Local governments can play a significant role due in part to their role in land use planning, zoning, and permitting. In some cases local governments have direct control over certain areas like land use and in others local governments are implementing state policies, such as California's statewide building energy standards.

In September 2008, the Energy Policy Initiatives Center (EPIC) released a study that estimated the San Diego region's greenhouse gas emissions and analyzed strategies to reduce regional emissions to 1990 levels by 2020. While a necessary step in the mitigation process, our first report did not provide any specific analysis to help decision makers understand which policy actions could achieve the savings identified nor did it provide any way to prioritize activities and policies. The purpose of this study is to assess policy options based on their potential to reduce greenhouse gases, cost and time to implement, and experience by other jurisdictions.

This report is not intended to be a detailed cost effectiveness or GHG reduction analysis; rather, the results included here are intended as preliminary information to communicate to decision makers relative cost and GHG reduction potential. In many cases, we provide quantitative analysis, but in cases where policies either would not have a direct GHG effect or where it is difficult to ferret out the potential effect of a specific policy, we did not include any quantitative treatment. Table 1 provides a list of all the policies evaluated in this report, indicates whether quantitative GHG emissions and cost analysis was conducted, and includes a sample of jurisdictions that have adopted a version of the policy or measure listed.

Several points of clarification will help the reader to understand the reasons for including or excluding certain topics. First, we recognize that while GHG emissions are an important barometer, they are but one piece of the larger question of sustainability and that it is important to consider a broader, comprehensive perspective when assessing policy actions. Other important considerations include air quality, waste reductions, and economic and workforce development. Nonetheless, this report focuses on the issue of GHGs as a potential driver of negative outcomes in many of these other areas.

Second, this study focuses on policies to *mitigate* existing emissions. There is a growing debate about the relative roles of mitigation, or reducing GHG emissions, and *adaptation*, changing the way we plan and live in order to adapt to an altered future because of climate change. Adaptation is an important topic that warrants serious discussion but is outside the purview of this report.[1]

This report also focuses on policies that local governments can adopt because their jurisdiction allows them to directly regulate an area or to influence state and federal policies. An example would be a local government requiring all new homes to install Energy Star appliances. Appliance standards are the jurisdiction of the federal and state governments, but by exercising local jurisdiction, a local government can influence the effectiveness of a state or federal appliance standard.

[1] For more on the potential regional effects of climate change, see San Diego's Changing Climate: A Regional Wake-Up Call – A Summary of the Focus 2050 Study Presented by the San Diego Foundation, *available at* http://www.sdfoundation.org/news/pdf/Focus2050glossySDF-ClimateReport.pdf.

Table 1 Summary of Policies Evaluated

POLICY OR MEASURE	GHG REDUCTION AND COST ESTIMATE	JURISDICTIONS THAT HAVE ADOPTED THE POLICY OR MEASURE
Energy Efficiency		
Regional or Citywide Building Assessment	N	N/A
Regional or Citywide Energy Efficiency Target (Existing)	N	Palm Desert (CA), San José (CA)
Regional or Citywide Existing Building Efficiency Task Force	N	Austin (TX), Seattle (WA)
Energy Rating and Disclosure (Existing)	Y	Austin (TX), Montgomery County (MD), European Union
Efficiency Retrofits	Y	Berkeley (CA), San Francisco (CA), Austin (TX), Wisconsin, New York City (*proposed*)
Retro-Commissioning for Commercial Buildings	Y	New York City *(proposed)*
Solar Water Heating (New and Existing Buildings)	Y	Spain
Enhanced New Construction Building Energy Standards	Y	San Francisco (CA), City of Santa Barbara (CA), Palm Desert (CA), Marin County (CA), 10 other CA Cities
Energy Efficiency Appliances (New Buildings)	Y	Santa Barbara (CA)
Energy Rating and Disclosure (New Buildings)	N	Kansas, South Dakota
Pre-Plumb for Solar Water Heating (New Buildings)	Y	Chula Vista (CA), Carlsbad (CA)
Photovoltaics		
Regional or Citywide Rooftop Photovoltaics Target	N	San Diego (CA) San Francisco (CA), Sonoma (CA)
Pre-wire for Photovoltaics	Y	Chula Vista (CA), Palm Desert (CA)
Photovoltaics on New Buildings - Commercial	Y	Culver City (CA)
Photovoltaics on New Buildings - Residential	Y	N/A

Finally, this report focuses on policies that can reduce GHG emissions across the entire population of a city or county. Local government GHG emissions inventories are often broken into two categories: city operations and the entire community. We chose to focus on community-wide emissions in part because even though cities have direct control over their own operations, these emissions only account for a small percentage of total emissions within a given jurisdiction. For example, GHG emissions from the City of San Diego constitute approximately 1% of the all the GHG emitted within the City boundaries. So even if the City of San Diego eliminated its emissions completely, it would only account for a very small portion of overall citywide emissions. Instead this report seeks to provide information and analysis on policy options to reduce GHG emissions throughout an entire jurisdiction.

1.1. Key Findings

- To achieve 1990 levels of regional greenhouse gas (GHG) emissions by 2020, it would be necessary to reduce electric consumption by 10%, reduce natural gas use by 8%, and increase total distributed photovoltaics to 400 megawatts (MW) in the San Diego Region, according to the San Diego Greenhouse Gas Inventory report.
- If local governments do not adopt any policies relating to reducing electric and natural gas usage and increasing use of photovoltaics, a certain level of greenhouse gas (GHG) reductions will occur as a result of statewide programs and policies.

  - Projected GHG emissions reductions from statewide appliance and buildings standards and utility energy efficiency programs could achieve about 0.7 million metric tons of carbon dioxide equivalent (MMT CO_2E), 73% of the amount needed (0.9 MMT CO_2E) from measures to reduce electric and natural gas consumption to achieve the hypothetical regional target of 1990 emissions levels by 2020.
  - Similarly, projected GHG emissions reductions from statewide programs to promote photovoltaics could achieve about 0.1 MMT CO_2E, about 50% of the amount needed (0.2 MMT CO_2E) from measures to increase use of photovoltaics to achieve the 2020 target.
  - Expected emissions reductions from statewide electric and natural gas policies combined with photovoltaics measures could achieve MMT CO_2E, about 70% of the level needed to reach the 2020 target.
- Local government policies related to energy efficiency and photovoltaics could help to contribute to the remaining emissions reductions needed to meet the 2020 targets (after counting the effects of statewide measures).
- A range of policy options exists within the authority of local governments to reduce community-wide greenhouse gas emissions.
- All policies analyzed for this report can be developed and implemented in the short term (1-2 years).
- One or more local governments in California or the U.S. have adopted most of the policies assessed.
- Based on the assumptions used, preliminary quantitative analysis suggests that five local policies have a high potential to reduce GHG emissions in the San Diego region: (1) residential and (2) commercial efficiency retrofits in a percentage of all existing buildings[2], (3) residential photovoltaics in all new homes, (4) solar water heating retrofits in a percentage of all homes, and (5) residential retrofits that target a percentage of buildings built prior to 1980.
- Among the policies with high potential to reduce GHG emissions, only one policy – efficiency retrofits in commercial buildings[3] – also has a relatively low cost per unit of greenhouse gas reduction (dollar/metric ton CO_2 equivalent).
- Retro-commissioning[4] in commercial buildings also has a low cost of implementation and a medium to low potential to reduce emissions, depending on the population of buildings targeted. Another policy – requiring Energy Star appliances in new homes – also has a low cost per unit of GHG reductions, though it has a relatively low potential to reduce emissions.
- Of the local energy efficiency policies assessed, those targeting existing buildings have a higher potential to reduce GHG emissions than those targeting new construction or solar

[2] For existing building policies, we calculate potential greenhouse gas reductions assuming the policy is applied both to a percentage of all buildings as of 2010 and as a percentage of buildings built prior to 1980, about when California adopted building energy standards.

[3] "Commercial building" as used here means all non-residential and non-industrial buildings and would include government buildings.

[4] The California Energy Commission defines retro-commissioning as the process of "systematically investigat[ing] the operation of a building's energy consuming equipment to detect, diagnose, and correct faults in the installation and operation of commercial building energy systems." Retro-commissioning is typically only done in commercial buildings.

photovoltaics. Emission reductions from policies that focus on efficiency in existing buildings represent 0.3 to 0.5 MMT CO_2E, about 72% to 85% of the total potential, respectively, depending on the population of buildings targeted.

- If every local jurisdiction in the region adopted the efficiency and photovoltaics policies assessed in this report the emission reductions associated with the medium scenario[5] would be approximately 0.6 MMT CO_2E, about 60% of the estimated levels needed for the region to meet the hypothetical 2020 target; however, the combined emission reductions of these local policies and state building and appliance standards and utility energy efficiency programs would be significantly higher and likely would meet the hypothetical 2020 targets.
- Looking beyond 2020, it appears that more aggressive local policy actions could be necessary to achieve significant reductions of 80% below 1990 levels by 2050.
- Recommendations for further research and analysis include the following:
  - Conduct a detailed analysis of the existing building stock in San Diego County to validate and refine the estimates developed in this report. At a minimum, it would be necessary to characterize the building stock by type (single family, multi-family, etc.), vintage, climate zone, etc.
  - Conduct a more detailed cost analysis to validate and refine preliminary estimates and to account for any unique characteristics that may exist.
  - Conduct analysis on the implications for regional electric and natural gas use of reducing regional emissions 80% below 1990 levels by 2050. This is the level of emissions reductions contained in California Executive Order S-3-05 and contemplated by federal legislation.
  - Develop model policy language and supporting documentation for a subset of feasible policy options.

1.2. Organization of the Report

The report is organized into the following sections.

- In Section 2, we provide background information necessary to provide a context for the subsequent policy analysis. This section includes a brief overview of the San Diego County Greenhouse Gas Inventory study and the connection to the material covered in this report.
- A discussion of policies to encourage energy efficiency policies for existing buildings and new construction is covered in Section 3. This section includes evaluation of policies such as energy auditing and disclosure, residential and commercial retrofits, and commercial retro-commissioning.
- Section 4 includes a discussion of policies to encourage use of distributed solar photovoltaics, including pre-wiring to make new homes solar ready and requirements to include photovoltaics on all new residential and commercial buildings.
- The report's overall findings are presented in Section 5.
- General conclusions are presented in Section 6, which includes an overview of areas for further study.

[5] For each policy, we calculated potential greenhouse gas reductions based on varying assumptions to yield a low, medium, and high estimate. All values presented here represent the medium scenario unless otherwise noted.

- Section 7 is the Appendix, which includes information about the methodology used to estimate GHG emission reductions and implementation costs.

2. BACKGROUND

2.1. Regional Greenhouse Gas Inventory Results

The Energy Policy Initiatives Center's (EPIC) San Diego Greenhouse Gas Inventory project developed a GHG inventory for San Diego County to better understand the emissions sources in the region.[6] The project team calculated historical GHG emissions from 1990 to 2006 using the best available data, and then estimated future emissions to 2020. Using emissions reduction targets codified in California's Global Warming Solutions Act of 2006 (AB 32) as a guide, the study also sought to establish emissions reductions targets for the region. Although AB 32 does not require individual sectors or jurisdictions (e.g., cities and counties) to reduce emissions by a specific amount, the study calculated the theoretical emissions reductions necessary in each emissions category (e.g., transportation, electricity, etc.) for San Diego County to reduce emissions to 1990 levels by 2020—the statewide statutory target under AB 32.[7]

2.1.1. Key Findings from the San Diego Regional Greenhouse Gas Inventory

The following are among the key findings from the San Diego regional greenhouse gas inventory:

- San Diego County emitted 34 million metric tons of carbon dioxide equivalent (MMTCO_2E) in 2006 – an 18% increase over 1990 levels, commensurate with population growth during the same period.
- In 2006, per-capita emissions for San Diego County were 12 metric tons CO_2E, which is slightly lower than California as a whole (13) and significantly lower than the U.S. levels (24). California's lower per capita emissions can be attributed mostly to weather but also include the effects of the state's comparatively aggressive efficiency programs since the 1970s.[8]
- In 2006, emissions from cars and light-duty trucks represented 46% of total greenhouse gas emissions in San Diego County.
- By 2020, under a business-as-usual scenario, regional GHG emissions are expected to be 43 MMT CO_2E, an increase of 9 MMT CO_2E (26%) over 2006 levels and 14 MMT CO_2E (48%) over 1990 levels.
- To meet AB 32 emissions reduction targets (1990 levels by 2020), San Diego County would have to reduce emissions by 14 MMT CO_2E (33%) below projected business-as-usual levels in 2020.

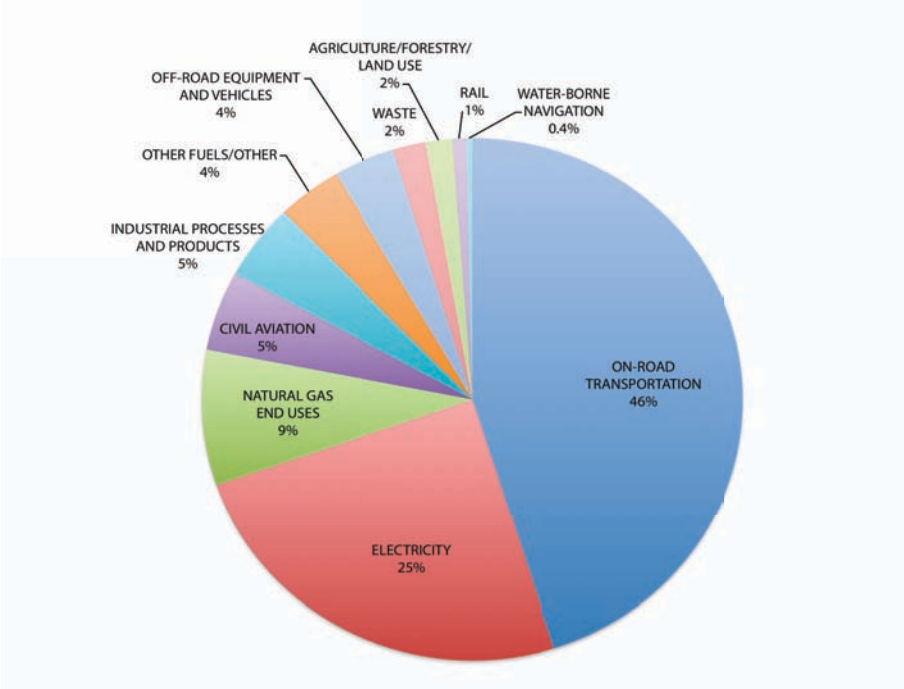
[6] Electronic copies of the executive summary and 8 supplements sector reports are available on the EPIC website at http://www.sandiego.edu/epic/ghginventory/.

[7] To do this, we adapted the well-know approach used by Pacala and Socolow. See Pacala, S. and Socolow, R., Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies, Science, 305, 968-972 (2004).

[8] The gap between California and the US average presented here have not been adjusted for weather, but it has been shown that the lower per capita energy use in California is due to about 2/3 climate advantages and 1/3 to state energy efficiency measures since the 1970s. See Schipper, L and McMahon, J., Energy Efficiency in California: A Historical Analysis (1995).

Figure 1 summarizes the results of the San Diego regional greenhouse gas inventory. It shows the relative contribution of emissions from each sector analyzed. Electricity (25%) and natural gas (9%), the focus of this report, account for about 34% of all regional emissions.

Figure 1. San Diego County GHG Emissions by Category (2006)



The GHG inventory project also identified 19 broad emissions reduction strategies that in combination could reduce regional GHG emissions to 1990 levels by 2020. Table 2 presents the strategies related to electricity and natural gas use. Several strategies – renewable portfolio standards, cleaner electricity purchases, replacing Boardman contract (coal), increasing use of combined heat and power – are either not within the purview of local governments or there are limited local barriers to implementation and are therefore not considered here. This report focuses on three broad strategies – reducing electric and natural gas consumption and increasing distributed photovoltaics – that taken together equal about 7% of the total GHG emissions reductions needed to lower regional emissions to 1990 levels by 2020. The total emissions reduction target from energy efficiency activities – both electric and natural gas – is 0.9 MMT CO_2E, and 0.2 MMT CO_2E from increased use of photovoltaics. The analysis below will compare potential GHG reductions of specific policies and groups of policies to these values.

Table 2. Emissions Reduction Strategies for the Electricity and Natural Gas Categories[9]

Emissions Category / Strategy	Reduction Amount (MMT CO_2E)	Percentage of Total Reduction
ELECTRICITY	**3.8**	**28%**
Renewable Portfolio Standard 20%	1.2	8%
Reduce Electricity Consumption 10%	***0.7***	***5%***
Renewable Portfolio Standard 33% (Incremental)	0.7	5%
Cleaner Electricity Purchases (≤1100 lbs/MWh)	0.6	4%
Replace Boardman Contract (Coal)	0.3	2%
Increase Distributed Photovoltaics to 400 MW	***0.2***	***1%***
Increase Combined Heat and Power by 200 MW	0.2	1%
NATURAL GAS END-USE	**0.3**	**2%**
Reduce Natural Gas Consumption 8%	***0.3***	***2%***

2.2. Cost Considerations of Mitigation Strategies

The San Diego Greenhouse Gas Inventory study did not include any discussion of cost; rather, it was intended simply as an accounting of emissions and analysis of how the region could meet AB 32 targets. An obvious question remains: what are the most cost effective mitigation strategies? This report seeks to provide a preliminary answer by providing cost estimates for local policies that can reduce emissions in the San Diego region.

Two studies are helpful in providing background on the cost of GHG mitigation strategies. The first study is a well-known study by McKinsey & Company that estimates the abatement costs of reducing GHG reduction measures in the U.S.[10] It shows that a range of mitigation technologies have a *negative* abatement cost ($/ton GHG); that is, their lifecycle cost is below zero. Another way to put this is that the money saved over time by implementing such measures is greater than the installation cost. The study shows that in general but not exclusively, many of the measures with negative abatement costs are related to efficiency. For example, improvements in lighting efficiency – both for the residential and commercial sectors – have significant potential to reduce emissions and have very low (negative) abatement costs. Further, improvements to new building shell efficiency also have similar potential and costs. Costs associated with improving the energy performance of the residential building shell in existing buildings has a slightly positive abatement cost and a relatively small potential for emissions reductions. Distributed

[9] Results for several electricity related strategies have been modified due to a refined methodology and updated energy forecast. For instance, the amount of GHG emissions expected from energy efficiency has been revised down to 0.68 MMT CO_2E from 1.1 MMT CO_2E. The total amount of GHG reductions from the electricity sector still meets the 1990 target by 2020. Also, the natural gas value has been revised down to 0.26 MMT CO_2E from 3.0 MMT CO_2E.

[10] Jon Creyts et al., Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?, McKinsey & Company and The Conference Board (Dec. 2007).

photovoltaics have a relatively high cost and potential, according to the McKinsey & Company study. Efficiency improvements to residential and commercial heating, ventilation, and air conditioning equipment (HVAC) have a relatively high abatement cost but also have a relatively high emissions reduction potential.

A similar study was conduced by the Precourt Institute for Energy Efficiency at Stanford University to assess the marginal abatement costs of a set of measures to meet California's statutory GHG targets.[11] The results are very similar to the McKinsey & Company report, with a few exceptions. Energy efficiency is shown to be a negative cost measure; however, the Precourt study shows photovoltaics as having a negative cost lower than that of energy efficiency, though photovoltaics is shown to have a relatively small potential to reduce GHG emissions. Unlike the McKinsey & Company report, the Precourt report shows that it would require nearly all the measures being considered to meet the stated targets.

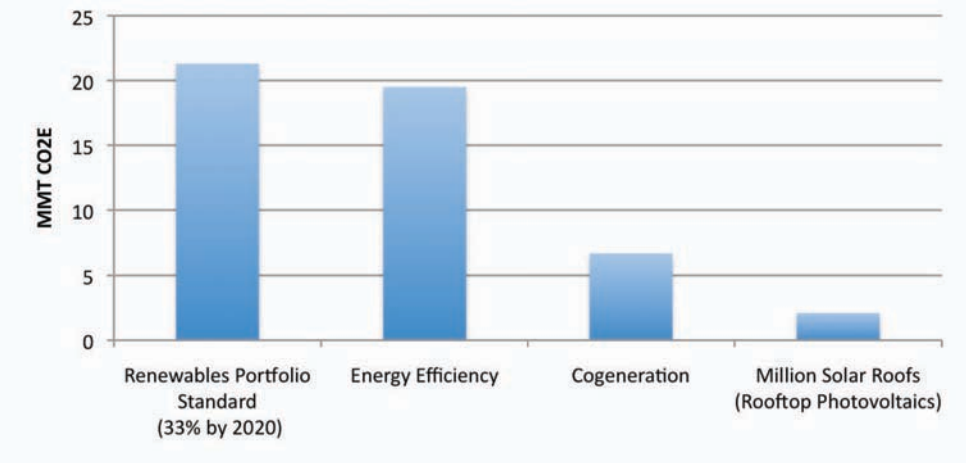
As mentioned in the introduction, this report is not intended to be a detailed cost effectiveness study; rather, this report seeks to provide preliminary information to compare the GHG reduction potential against the potential cost of implementation. For nearly each policy evaluated in this report, we provide a discussion of compliance costs, including data from published reports and studies. We estimate life-cycle costs and GHG reductions to create a metric (dollars per ton of MMT CO_2E reduction) that normalize the cost and allows comparisons among policies. Details on the assumptions used to estimate GHG reduction and cost are included in Section 7.

[11] Jim Sweeney, John Weyant, et al., Analysis of Measures to Meet the Requirement of California's Assembly Bill 32, Precourt Institute for Energy Efficiency, Stanford University (Sept. 27, 2009).

3. ENERGY EFFICIENCY

In the San Diego Region 34% of emissions are associated with electricity and natural gas use.[12] While strategies targeting supply, such as a renewable portfolio standard, likely will significantly reduce emissions, reducing consumption through efficiency will play an important role. In the San Diego County Greenhouse Gas Inventory report, we estimated the GHG reduction impacts of 19 strategies, including energy efficiency. As part of a suite of strategies to meet AB 32 targets, electric and natural gas efficiency in the san Diego region could account for 0.9 MMT CO_2E, about 6% of the overall GHG reductions needed.[13] Energy efficiency plays an even more significant role in California's plans to reduce greenhouse gas emissions to 1990 levels by 2020. The California Air Resources Board (CARB) proposes to reduce electric energy consumption by 32,000 gigawatt-hours and natural gas use by 800 million therms by 2020.[14] These levels of energy reduction in addition to expanded combined heat and power, are expected to account for 26 MMT CO_2E (15%) of all the estimated GHG reductions outlined in the CARB's Climate Change Scoping Plan, second in magnitude only to reductions associated with light-duty vehicle emissions controls, which account for 32 MMT CO_2E (18%).[15] Figure 2 presents the expected GHG reduction sources from the electricity and natural gas sector contained in the CARB Scoping Plan.

Figure 2 Role of Efficiency in the CA Air Resources Board Scoping Plan



[12] Scott Anders et al., San Diego County Greenhouse Gas Inventory: An Analysis of Regional Emissions and Strategies to Achieve AB 32 Targets. University of San Diego – Energy Policy Initiatives Center (Sept. 2008).

[13] Estimated GHG reduction potential for a 10% decrease in electricity consumption was revised down due to refinements in the calculation methodology and a new California Energy Commission electricity forecast.

[14] California Air Resources Board. Climate Change Scoping Plan: a framework for change, DECEMBER 2008. p. 41. *Available at* http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf.

[15] *Id.* at 17.

Other state policies underscore the importance of energy efficiency. On Sept. 18, 2008, the CPUC adopted its Long-Term Energy Efficiency Strategic Plan ("Plan").[16] The Plan outlines strategies and actions between 2009 and 2020 to achieve maximum energy savings in California. The CPUC Plan includes aggressive efficiency goals, including that:

- By 2020, all new homes are net zero energy.
- By 2020, energy consumption in existing homes will be reduced by 40%.
- By 2030, all new commercial buildings will be net zero energy.
- By 2030, 50% of existing commercial buildings will be retrofit to net zero energy.

This section provides background information on energy efficiency, including a discussion of local government jurisdiction in the area of electric and natural gas efficiency, the regional building stock, the remaining potential for efficiency in the San Diego region, and a range of local government policies to reduce greenhouse gases. Each policy is described in detail including information about its potential to reduce GHG emissions, experience from other jurisdictions, cost, time to implement, and policy considerations for local governments considering such policies.

3.1. Background on Energy Efficiency

3.1.1. The Role of Local Government in Energy Efficiency

In general, matters of energy efficiency are regulated by state and federal agencies. In California, state agencies have significant control over energy efficiency. The California Public Utilities Commission (CPUC), which regulates the investor-owned electric and natural gas utilities (IOU), administers the portion of the public good monies used to fund energy efficiency programs. The CPUC establishes energy efficiency targets for IOUs and approves all energy efficiency funding expenditures. The California Energy Commission (CEC) promulgates new building energy standards, known as Title 24, and appliance standards. Despite state regulation of electric and natural gas efficiency in California, local governments can play an important role in promoting efficiency either through direct local regulation or by adopting local policies that support or influence state policy.

An example in which local governments exert direct control is an ordinance to require certain energy efficiency upgrades at the time a building is sold. There is no commensurate state authority within the agencies that regulate energy efficiency in California, though such a requirement could be adopted by statute. An example of where local government can use its authority to influence a state policy is to require all new homes to have Energy Star appliances. Local governments do not promulgate appliance standards but by requiring Energy Star appliances, such a policy would support California's appliance standards, which are typically more aggressive than federal standards.

[16] California Public Utilities Commission. California Long-tem Energy Efficiency Strategic Plan: Achieving Maximum Savings in California for 2009 and beyond. *Available at*, http://www.californiaenergyefficiency.com/docs/EEStrategicPlan.pdf.

The CPUC's Long-Term Energy Efficiency Strategic Plan specifically addresses the role of local governments in promoting energy efficiency and includes the following specific recommendations for implementing energy savings targets.[17]

- At least 5 percent of California's local governments (representing at least 5 percent of CA total population) each year adopt "reach" (enhanced energy efficiency) codes.
- By 2020, the majority of local governments have adopted incentives or mandates to achieve above-code levels of energy efficiency (or DSM) in their communities, or have led statewide adoption of these higher codes.
- The current rate of non-compliance with codes and standards is halved by 2012, halved again by 2016, and full compliance is achieved by 2020.
- By 2015, 50 percent of local governments have adopted energy efficiency/sustainability/climate change action plans for their communities and 100 percent by 2020, with implementation and tracking of achievements.

The Plan also identifies the following areas where local government authority can reduce energy use in new and existing buildings.[18]

- Ensuring compliance and enforcement of the Title 24 energy code for residential and commercial buildings.
- Adopting building codes beyond Title 24's energy requirements (and potentially other "green" requirements).
- Supporting highly efficient projects that voluntarily exceed minimum energy codes through favorable fee structures, fast-tracked permitting and other innovative and locally appropriate approaches.
- Enacting ordinances with point-of-sale or other approaches that spur efficiency actions in existing, privately-owned buildings.
- Applying efficiency-related "carrots" and "sticks" using local zoning and development authority.

These and other policy options for local governments to encourage energy efficiency are discussed in detail in Section 4.2 and 4.3.

3.1.2. Data on San Diego Building Stock

While cars and trucks are the primary emitters of GHGs in the San Diego region, buildings are the next largest category of emitters. Approximately 80% of GHG emissions in the electricity category and 90% of emissions in the natural gas category are associated with buildings. Overall, electric and natural gas use associated with buildings accounts for about 28% of all greenhouse gas emissions in the region. Understanding from a broad perspective some information about the San Diego region's building stock can be very helpful on determining how to reduce its energy consumption.

[17] *Id.* at 11.

[18] *Id.* at 89.

Residential Buildings

According to the San Diego Association of Government housing stock data, in 2008 there were 1,147,900 housing units in the region, including single family, multi-family, and mobile homes. Just over 60% of all housing units (over 700,000) were built prior to 1980, about when building energy efficiency standards came into force in California (Table 3).

Table 3 San Diego Region Housing Units by Type for Selected Years[19]

Year	Single Family	Multi Family	Mobile Home	Total	Percentage of 2008 Total
1980	440,794	245,290	37,907	723,991	63%
1985	485,403	274,715	41,466	747,339	65%
1990	554,023	346,414	45,803	946,240	82%
1995	591,621	355,724	46,360	993,705	87%
2000	628,652	364,636	46,861	1,040,149	91%
2005	678,221	384,242	46,037	1,108,500	97%
2008	699,004	403,094	45,802	1,147,900	100%

On average between 1990 and 2008, just over 1% of the entire residential building stock was built new each year and about 3.5% was sold annually (Figure 3).[20] These proportions correspond roughly to statewide numbers, which estimate that roughly 3 times as many homes are sold in California each year than built new.[21] Though not enough data is publicly available to assess trends, limited data suggests that alterations and additions that receive permits account for about 1% of all existing buildings.[22] The CPUC estimates that the balance of renters to homeowners in California is about 42% to 58%, respectively.[23]

[19] Housing Data from the San Diego Association of Governments.

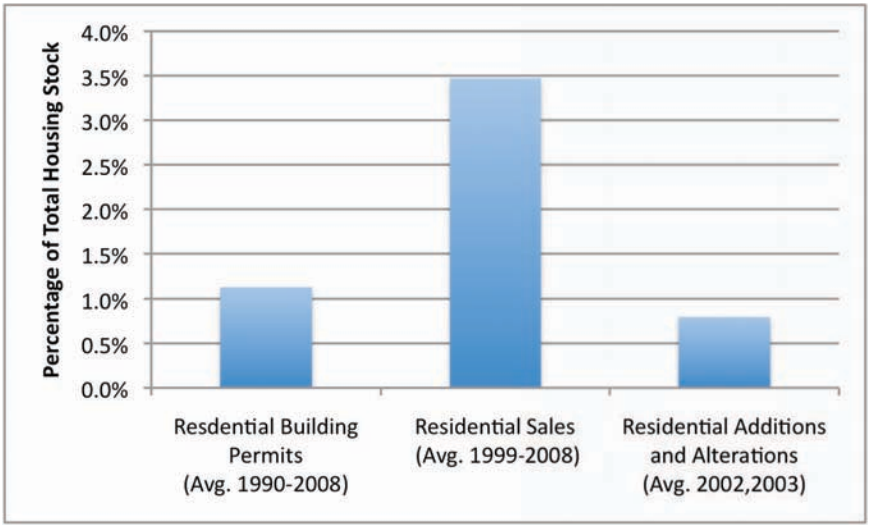
[20] Residential housing stock data provided by San Diego Association of Governments, residential permit data provided by the Construction Industry Research Board.

[21] California Energy Commission, Options for Energy Efficiency in Existing Buildings, p.21 (Dec. 2005).

[22] Rachel Roth. Using Additions and Alterations Permits to Estimate Remodeling Activity in Metropolitan Areas. Harvard University Joint Center for Housing Studies. (Oct. 2004).

[23] California Public Utilities Commission, California Long Term Energy Efficiency Strategic Plan, p.9 (Sept. 2008).

Figure 3 Residential Housing Trends, San Diego County



Efficiency policies that require efficiency upgrades typically have "trigger points" for compliance. In 2008, the California legislature considered but did not pass legislation that would have targeted certain efficiency policies at existing buildings at the time of sale. In the San Diego region, this would capture on average 3.5% of the existing building stock each year. In 10 years, assuming a home sells only once, this would capture 35% of the building stock. Policies targeted at new construction would capture less of the overall building stock. New construction standards only affect 1% of the entire building stock and such standards do not regulate all the energy consumed in the building.

Commercial Buildings

According to data from the CEC, the San Diego region had a total of 537 million square feet of commercial real estate space in 2008. Unlike residential buildings in the region, significant commercial development occurred between 1980 and the present. In 1980, only about 40% of today's commercial building space was already constructed. Table 4 presents the trends of commercial building space, including building space as a percentage of the total that existed in 1980.

Table 4 Commercial Buildings Square Footage for Selected Years[24]

Year	Total Square Footage (MM SF)	Percentage of 2008 Total
1980	208	39%
1985	263	50%
1990	337	64%
1995	388	74%
2000	436	83%
2005	500	95%
2008	528	100%

The type of lease arrangement and term of the lease can be an important factor to determine the building occupant will invest in energy efficiency improvements. In a report on options to reduce energy use in existing buildings, the CEC estimates that in California 23% of commercial floor space is leased. Of that percentage, about 50% are net leases, in which the tenant pays many of the property expenses, including electric and natural gas utility costs.[25] These data on leasing in California indicate that the split incentive problem, where energy efficiency retrofits are not conducted because the building owner does not pay utility expenses and the building occupant does not own the building, remains a significant challenge.

3.1.3. Energy Efficiency Potential in the San Diego Region

There are several primary policy approaches that have been used to reduce energy consumption in California: energy efficiency programs, building standards, and appliance standards. The combination of these has yielded significant energy reductions in California since the 1970s. The CEC estimates that between 1975 and 2003, the cumulative energy savings from efficiency programs and standards are 40,000 GWh, which is equivalent to about 15% of total electricity consumption in 2003.[26]

In this case, energy efficiency programs are defined as those administered by the IOU and funded by the public purpose program charge paid by electric and natural gas utility customers. In 2006, this charge was $0.0585 per kilowatt-hours and represented approximately 4% of the typical San Diego Gas & Electric customer bill.[27]

[24] California Energy Commission. Final Staff 2009-2020 Forecast (Sept. 2009). Form 2.2 - SDG&E Planning Area California Energy Demand 2008-2018 Staff Revised Forecast Planning Area Economic and Demographic Assumptions.

[25] California Energy Commission. Technical Assistance in Determining Options for Energy Efficiency in Existing Buildings-Appendices, p. F-47 (Dec. 2005).

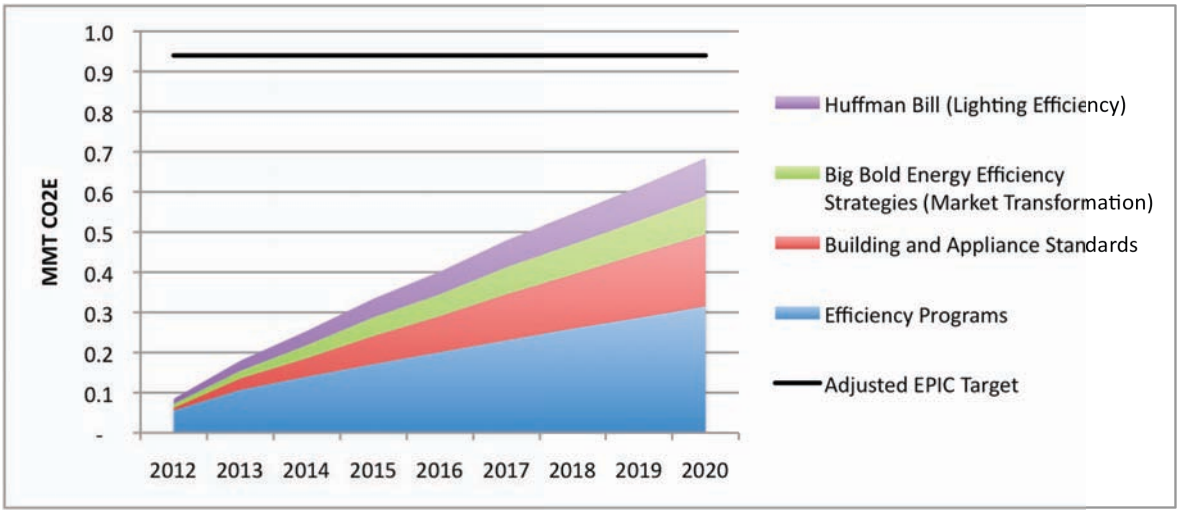
[26] California Energy Commission, Options for Energy Efficiency in Existing Buildings, p. iii (Dec. 2005).

[27] Kuduk, Adi, and Anders, Scott. Following California's Public Goods Charge: Tracking Contributions and Expenditures of the Renewable Energy Program and the PIER Program. Energy Policy Initiatives Center University of San Diego School of Law (Sept. 2006).

California's residential and nonresidential energy efficiency standards for buildings are contained in Title 24, Part 6, of the California Code of Regulations.[28] The standards, which were established in 1978 in response to a legislative mandate to reduce California's energy consumption, are updated regularly to allow for incorporation of new energy efficiency technologies and techniques. The latest iteration of California's building efficiency standards (2008 version) will take effect in October 2009.[29] California's Appliance Standards, which are contained in Title 20 of the California Code of Regulations, were adopted in 1976 and are periodically updated.[30]

Estimates vary on what level of future energy reductions will be attributed to efficiency programs and standards over the next decade, depending on the assumptions used. The CPUC estimates that in the San Diego region, efficiency programs will achieve gross savings of 1,514 GWh and 52 million therms between 2012 and 2020, the largest contributor to energy reductions over this period.[31] Figure 4 presents the GHG emissions reduction implications from the CPUC estimates of future energy savings for the San Diego region. This combination of savings falls short of the adjusted EPIC target of 0.9 MMT CO_2E for energy efficiency by about 30%, which highlights the role of local government policy in reducing GHG emissions.

Figure 4 GHG Reductions from CPUC Estimate of Future Electric and Natural Gas Savings[32]



Energy Efficiency Program Potential

Itron Inc. conduced a detailed, bottom-up study of energy efficiency program potential in San Diego County through 2016 with a long-term projection for 2026.[33] "The primary objective of

[28] CCR Title 24, Part 6.

[29] 2008 Building Energy Efficiency Standards, *available at* http://www.energy.ca.gov/title24/2008standards/.

[30] California's Appliance Efficiency Program, a*vailable at* http://www.energy.ca.gov/appliances/.

[31] Decision 08-07-047 (Table A-6), issued July 31, 2008 in Rulemaking 06-04-010.

[32] California Public Utilities Commission Rulemaking 06-04-010 D.08-07-047 Table A-6, *available at* http://docs.cpuc.ca.gov/WORD_PDF/FINAL_DECISION/85995.DOC.

the work underlying this report was to produce estimates of remaining potential energy savings that might be obtainable in the near (2007-2016) and foreseeable (2017-2026) future through *publicly funded energy efficiency programs* in the existing and new residential, industrial, and commercial sectors"(emphasis added).[34] The purpose of the study was to identify energy savings potential in the residential, commercial, and industrial sectors both for new construction and existing buildings. As noted above, there are other sources of energy reductions; however, the Itron values provide a reasonable proxy of remaining potential and can help local governments target GHG mitigation efforts.

The Itron analysis includes three basic scenarios: (1) base incentive scenario, which includes measures that received incentives in the 2004-2005 energy efficiency program cycle but sets incentive levels to those available in 2006 (this is effectively business as usual); (2) mid incentive, which includes the same measures as the base incentive scenario but sets incentive levels halfway between those available in 2006 and the full incremental cost; (3) full incentive, which sets incentives for all measures to the full incremental cost.[35]

Each of these scenarios were then restricted by allowing only measures that had a total resource cost (TRC) equal to or greater than 0.85; that is, for every dollar invested in an efficiency measure or program, the total benefits to the participant and society would be no less than $0.85. A broad portfolio would have measures above this level and the overall goal is to have a total portfolio TRC over 1, so that the portfolio breaks even in terms of initial costs and long-term societal benefits. The higher the TRC value is above 1 the more cost effective the portfolio.

For purposes of analyzing the GHG implications of future energy efficiency programs and policies in the region, the mid-restrict scenario is a reasonable target and is the basis for the energy efficiency program analysis included here. Table 5 shows the energy savings estimates for the three restricted scenarios for electric and natural gas energy savings. It shows that the energy savings estimates for the mid-restrict scenario for electric efficiency represents just over 4% of the projected 2020 consumption levels. The mid-restrict scenario for natural gas is equivalent to 4% of the 2020 projection. By comparison, EPIC estimates that it would be necessary to reduce electric consumption by 10% and natural gas consumption by 8% to realize sufficient GHG reductions from energy efficiency to reach the hypothetical target of 1990 level emissions in the region by 2020. Additional energy savings is likely to come from statewide building and appliance standards.

[33] Itron, Inc., California Energy Efficiency Potential Study- CALMAC Study ID: PGE0264.01, (Sept. 2008).

[34] *Id.* at p. ES-2. The report states that "Market potential denotes the energy savings that can be expected to result from specific scenarios relating to program designs and market conditions. Market potential was estimated under 10 scenarios relating to incentive levels, market awareness, cost effectiveness, and the base lighting technology."

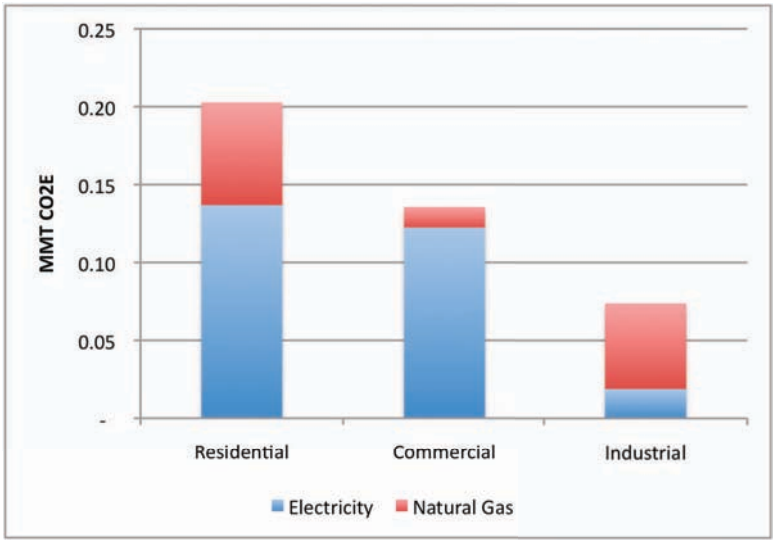
[35] *Id.* at p. 4-2.

Table 5 Projected Energy Reductions from Efficiency Programs (San Diego County, 2020)[36]

ITRON Scenario	Gross Electric Savings (GWh)	Percentage of 2020 Electric Consumption	Gross Natural Natural Gas Savings (MMTherms)	Percentage of 2020 Natural Gas Consumption
Base Restrict	843	3.5%	14	2%
Mid Restrict	1045	4.3%	25	4%
Full Restrict	1140	4.7%	31	5%

The Itron study results show that the residential sector has the highest remaining potential for energy program reductions, representing 49% of the total potential, followed by the commercial (34%) and industrial (17%) sectors. Figure 5 shows the greenhouse gas reductions associated with Itron's estimates. Existing buildings represent 89% of the energy reduction estimate, while new construction represents 11%. The residential existing building sector represents over 48% of the entire efficiency potential identified in the analysis. Commercial existing buildings have the second highest potential for energy reductions at 24% of total and existing industrial buildings account for about 17% of the total. Figure 6 presents the breakdown of GHG emissions associated with energy reductions in each of the sectors covered.

Figure 5 Projected GHG Reductions from Energy Efficiency Potential - Itron Mid-Restrict (San Diego County, 2020)



[36] Values represent incremental energy efficiency potential between 2009-2020. Electric energy projection for San Diego County.

Figure 6 Projected GHG Reductions from Efficiency Programs (San Diego County (2020)

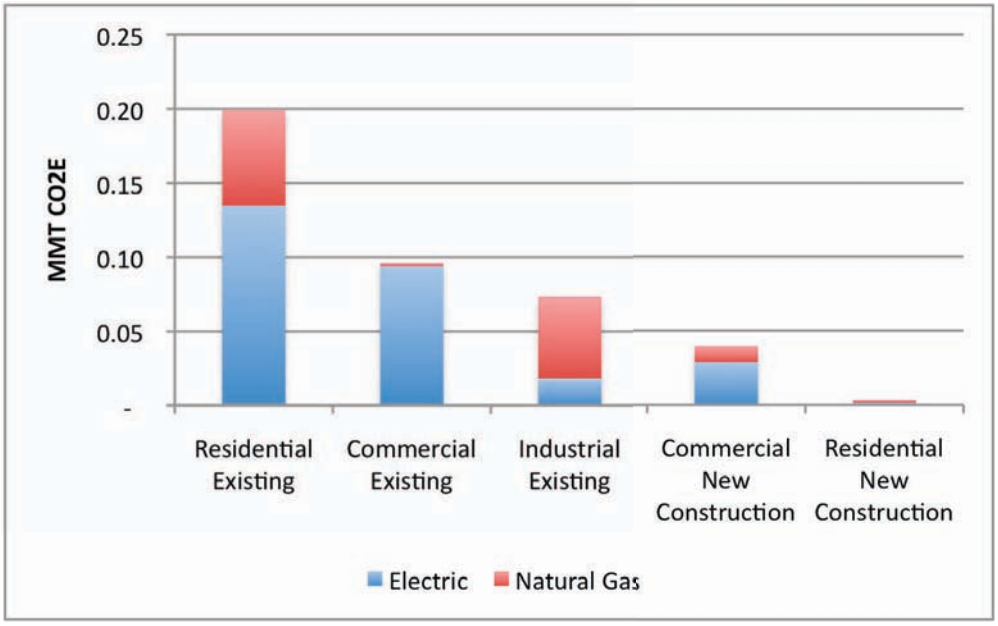


Table 6 provides a summary of the natural gas and electric energy savings estimates and their corresponding greenhouse gas reduction potential. The total GHG emissions reductions associated with the energy savings from programs is 44% of the revised EPIC target for electric and natural gas reductions (0.94 MMT CO_2E).

Table 6 Summary of the Itron Efficiency Program Potential Study (San Diego County, 2020)

Sector	Natural Gas (MM Therms)	Natural Gas MMT CO_2E	Electric (GWh)	Electric MMT CO_2E	Total MMT CO_2E
Commercial Existing	0.4	0.002	352	0.1	0.1
Commercial New Construction	2.0	0.01	108	0.03	0.04
Industrial Existing	10.2	0.06	69	0.02	0.1
Industrial New Construction	n/a	n/a	2	0.001	0.001
Residential Existing	12.0	0.1	505	0.1	0.2
Residential New Construction	0.2	0.00	9	0.002	0.003
Total	**24.8**	**0.13**	**1045**	**0.28**	**0.41**

3.2. Policy Options for Reducing Energy In Existing Buildings

Based on results from Itron's energy efficiency potential study, it is clear that the existing building sector has the highest non-standards-based energy savings potential, particularly in the residential sector, and likely should be a priority of regional and citywide policies to reduce greenhouse gases. Challenges exist to reduce energy use in the existing building sector. For example, many residential renters or commercial entities leasing property have no incentive to reduce energy costs because they do not own the building and the owner does not have an incentive because she does not pay the energy bills – this dilemma is known as the "split

incentive." Also, the retrofitting needs of each building or home can be different and more costly, customized approaches may be necessary.

As mentioned above, the CPUC has established ambitious energy efficiency targets to reduce the state's energy use in existing homes. It seeks to reduce energy consumption in existing homes by 20% by 2015 and 40% by 2020.[37] To reach these targets would require over 1 million retrofit projects annually until 2020 – about 3,400 projects a day until 2020. In San Diego County, retrofitting all 1.15 million homes would require over 300 retrofits a day until 2020. Table 7 provides a range of penetration and energy savings rates that would be required to reach the electric energy efficiency potential identified by Itron for the San Diego region's existing residential building sector by 2020. For example, it would be possible to reach the 505 GWh energy savings number if 25% of all the homes that existed in San Diego County in 2009 reduced electricity use by about 30%. The table provides values for reductions in all buildings in 2009 and only for buildings that were built in 1980 or earlier.

Table 7 Penetration and Energy Savings Rates to Reach Itron's Electric Efficiency Program Potential Estimate in Existing Residential Homes by 2020 (San Diego County)

	Total	Annual	Monthly	Weekly	Daily	Electricity Reduction Needed (kWh/unit)	Reduction as Percentage of Median Residential Consumption
All 2009 Residential Units	1,151,296	104,663	8,722	2,180	363	439	7%
All Pre-1980 Residential Units	723,991	65,817	5,485	1,371	229	698	11%
50% of 2009 Residential Units	575,648	52,332	4,361	1,090	182	878	13%
50% of Pre-1980 Residential Units	361,996	32,909	2,742	686	114	1,396	21%
25% of 2009 Residential Units	287,824	26,166	2,180	545	91	1,756	27%
25% of Pre-1980 Residential Units	180,998	16,454	1,371	343	57	2,792	42%
10% of 2009 Residential Units	115,130	10,466	872	218	36	4,389	66%
10% of Pre-1980 Residential Units	72,399	6,582	548	137	23	6,979	106%

The CPUC Strategic Plan also has established aggressive targets for existing commercial buildings. According to the plan, "50 percent of existing buildings will be equivalent to zero net energy buildings by 2030 through achievement of deep levels of energy efficiency and clean distributed generation."[38] This would be equivalent to retrofitting about 250 million square feet (1/20th of existing space) per year through 2030.

This section provides analysis on a range of local policies to reduce energy use in existing buildings, including information on the purpose, cost, GHG impacts, lessons from other jurisdictions, policy considerations, and pros and cons of each. A list of the policies and measures discussed in this section and examples of jurisdictions that have adopted similar policies is included in Table 8.

[37] California Public Utilities Commission, California Long Term Energy Efficiency Strategic Plan. Section 2, page 11.

[38] *Id.* at p. 31.

Table 8 Existing Building Policies and Measures

POLICY OR MEASURE	JURISDICTIONS THAT HAVE ADOPTED THE POLICY OR MEASURE
Regional or Citywide Building Assessment	N/A
Regional or Citywide Energy Efficiency Target (Existing)	Palm Desert (CA), San José (CA)
Regional or Citywide Existing Building Efficiency Task Force	Austin (TX), Seattle (WA)
Energy Rating and Disclosure (Existing)	Austin (TX), Montgomery County (MD), European Union
Efficiency Retrofits	Berkeley (CA), San Francisco (CA), Austin (TX), Wisconsin, New York City (*proposed*)
Retro-Commissioning for Commercial Buildings	New York City *(proposed)*

3.2.1. Strategic Jurisdiction-Wide Building Assessment

One of the barriers to realizing the energy savings in existing buildings is the relative lack of information and understanding about the regional building stock. A strategic assessment of all the buildings within a jurisdiction or the entire region, could help cities direct services and programs. This analysis could be done using the Geographical Information System (GIS), which can integrate and process data sets (layers) in a spatial format. For example, the first layer could be a map of every building within a given geographical area (e.g., city, region, utility service territory). The second layer of information could be the general building characteristic data (e.g. age, type, floor space). These two layers would allow a preliminary analysis to determine the age of neighborhoods and concentrations of building types. A final layer of electric and natural gas billing data could produce an energy-intensity (kWh/square foot) for every building in a specific area. Given the strong connection between energy and water, it may also be useful to integrate water billing data, though the number of water agencies in the region may make this difficult.

This analysis likely would have to be conducted in partnership with the local electric or natural gas utility and due to the confidential nature of utility billing data, no data could be released about individual customers. Utilities could use the results of such an analysis to target its own energy efficiency programs and services, but releasing the data to the public in a way that does not compromise confidentiality would help energy retrofit companies target their services to the areas that had the highest energy reduction potential. It may be possible to aggregate the data in a way that obscures individual customer confidentiality in order to release data to the public, particularly the private sector energy efficiency providers who might use the information to more effectively target their services. For example, if groups of single-family homes fall within a range of energy intensity, neighborhoods could be depicted as high users.

3.2.2. Regional and/or Citywide Target Energy Efficiency in the Existing Building Sector

As noted above, California has established aggressive statewide efficiency targets. Several local jurisdictions in California have established specific energy reduction targets as part of their climate action or sustainability planning. For example, the City of Palm Desert has developed a partnership with Southern California Edison, Southern California Gas Company, and the Energy Coalition, called Set to Save, which has established a goal of reducing energy use

citywide by 30% by the end of 2011.[39] In its Green Vision, the City of San Jose seeks to reduce per capita energy consumption by 50% in 15 years.[40]

3.2.3. Regional and/or Citywide Existing Building Energy Reduction Task Force

Since existing buildings could play such a significant role in meeting the region's GHG reduction targets, convening a Task Force to assess policy options can be an effective approach. One advantage to this approach is that broad participation from relevant stakeholders can yield policy recommendations that are politically feasible. It might be more efficient to convene a regional Task Force rather than convening city level groups and some level of coordination and harmonization across the region could be helpful. Alternatively, it might be feasible for the larger cities in the region to convene their own Task Forces and the medium to small sized cities to form sub-regional groups.

There are three prominent examples of city-based Existing Building Efficiency Task Forces or Committees. The Austin City Council established by resolution the Energy Efficiency Retrofit Task Force to "make recommendations for development of an ordinance relating to energy efficiency upgrades and retrofits for existing homes and commercial buildings."[41] The language of the resolution bound the task force to consider energy efficiency mandates when a homeowner attempts to sell an existing home. It also provided for guidance on the membership, specifying the stakeholder groups that would comprise the Task Force.[42] The City of Austin adopted a mandatory auditing and disclosure policy (See Section 3.2.4).

Seattle Mayor Mike Nichols established the Green Building Task Force to "provide guidance on appropriate policy mechanisms that the City can employ to achieve…" goals to reduce energy consumption in new and existing buildings.[43] The Task Force Charter sets up two committees: New Buildings Committee and Existing Building Committee. The charter also set forth policy options for consideration by the committees. The Existing Building Committee was charged with assessing two broad categories of polices. The first category consists of policies that provide financing and incentives that make energy efficiency upgrades cost effective and attractive to consumers. Options in this category could include public or private financing (including utility bill financing), expanded conservation programs, or energy efficiency tax credits. The second category includes policies that require increases in building energy

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[39] Palm Desert's 30% savings target is equivalent to 214.7 M kWh, 48,748 kW peak demand, and 5.7 M Therms Natural Gas, See http://www.settosave.com/.

[40] San Jose Green Vision – Energy Efficiency, *available at*, http://www.sanjoseca.gov/greenvision/EnergyEfficiency.asp.

[41] City of Austin Energy Efficiency Retrofit Task Force information *available at* http://www.ci.austin.tx.us/council_meetings/wams_item_attach.cfm?recordID=8560 (last visited May 19, 2009).

[42] Board of Realtors, "Green" Realtors, Real Estate Inspectors, Real Estate Appraisers, Mortgage Brokers, Mortgage Lenders, "Green" Lenders, Title Companies, County Clerks, Austin Multiple Listing Service, Energy Efficiency Auditors, Home Performance Contractors, The Resource Management Commission, The Electric Utility Commission, Affordable Housing Advocates, Consumer Protection Advocates, Energy Efficiency Advocates, Environmental Justice Advocates, The Austin Apartment Association, The Austin Tenants' Council, Small Multifamily Property Owners, The Building Owners and Managers Association, The International Facility Management Association, The U.S. Green Building Council Central Texas-Balcones Chapter, and The American Institute of Architects.

[43] City of Seattle Green Building Task Force Charter, *available at* http://www.seattle.gov/environment/documents/GBTF_Charter_revdraft8-26-08.pdf.

efficiency, including requiring disclosure of energy use history, energy efficiency audits, energy efficiency upgrades at the point of sale, or enhanced energy codes and standards. The Charter also specified the approximately 25 stakeholder groups that would comprise the Existing Building Committee.[44]

In early 2009 San Francisco Gavin Newsom convened a task force to make recommendations on how the city could reduce the energy use of its existing commercial building stock.[45] The Existing Buildings Efficiency Initiative task force comprises 19 key stakeholders from San Francisco's building ownership, developer, financial, architectural, engineering, legal, utility, and construction communities, who the Mayor selected for their knowledge and experience of the building industry.[46]

Cost to Implement a Stakeholder Existing Building Committee

The cost of a stakeholder committee depends on several factors including the scope of topics to be considered, whether or not consultants are used to conduct analysis, and the level of involvement of local government staff. The City of Seattle estimates that it cost approximately $250,000 to implement its Existing Building Committee.[47] This total includes $150,000 in consultant fees, which was used for policy analysis and facilitation, the time incurred by two city staff members, and administrative costs such as room fees and copying.

Time to Implement

The time needed to implement the committee process varies by the same factors considered above for cost to implement a committee. The City of Seattle's Green Building Task Force (GBTF) provides a representative example of the time necessary. Seattle's Mayor announced the GBTF in February 2008. It met monthly from June 2008 to January 2009 and completed its

[44] American Society of Home Inspectors, Atmosphere IEM, Inc. (Energy Efficiency Contractors - Residential), BOMA Seattle-King County, Certified Sustainable Development Professional (CSDP), Greenworks Realty ("Green" Realty), Historic Seattle, HomeStreet Bank, International Facility Managers Association, Kennedy Associates (Real Estate Investment Advisors), Keithly Barber Associates (Commissioning Agent), King County Executive's Office, McKinstry (Energy Service Contractors), Northwest Energy Efficiency Alliance, Northwest Energy Coalition (Environmental Advocate), Pacific Northwest Council of Carpenters, Puget Sound Energy, Seattle King-County Association of Realtors, Seattle Housing Authority, Seattle Steam, ShoreBank Enterprise Cascadia (Community Development Financial Institution), Sound Alliance (Social Change Advocate), Tenant's Union of Washington State, University Mechanical Contractors(Energy Efficiency Contractors, Commercial), Washington Land Title Association, and Washington Oil Marketers Association / Genesee Fuel & Heating.

[45] Mayor Launches Task Force to Green Existing Buildings (Feb. 13, 2009), *available at e* http://www.sfenvironment.org/our_sfenvironment/press_releases.html?topic=details&ni=448.

[46] Alexander Hamilton of the law firm MBV; Property manager Angelica Steinmeier; Barry Giles of Building Wise; Greg Cunningham, Enovity; Jeff Palmer, Able Engineering; Jim Smith, Cushman & Wakefield; Jim Cantrell, Cantrell Harris & Associates engineers; Kari Aycock, Hines; Kathy Diehl, US EPA; Laura Rodormer, Swinerton Management & Consulting; Lisa Galley, Galley Eco Capital; Panama Bartholomy, California Energy Commission; Peter Turnbull, PG&E; Peter Liu, New Resource Bank; Phil Williams, Webcor Builders; Raphael Sperry, Simon & Associates; Robin Bass, Hunstman Architectural Group; Steven Ring, Cushman & Wakefield; and William Young, Shorenstein Realty Services.

[47] Personal conversation with Jaimey Boawn, City of Seattle Sustainability and Environmental Department (June 12, 2009).

final policy recommendations report in April 2009.[48] The Existing Building Committee of the GBTF met between September and November 2008.[49] As noted above, the City of Seattle hired consultants to conduct policy assessments, which may have expedited the overall time needed to complete the process.

3.2.4. Energy Ratings and Disclosure

Rating and disclosure policies encourage or require building owners to hire a professional energy auditor or rater to assess the energy performance of the building. Typically an audit is conducted and the building is given an energy performance score using an accepted rating protocol such as the California Home Energy Rating System (HERS) and recommendations on how to improve energy performance. The purpose of rating policies is to disclose the projected energy use of the building to prospective occupants, analogous to the miles-per-gallon sticker on new cars or the energy consumption estimates on new appliances.

In 2008, the California Legislature considered but did not approve AB 2678 (Nuñez), which upon introduction proposed that the CEC develop requirements for energy audits of residential and commercial buildings at the time of sale.[50] The bill was amended and broadened to require the CEC to establish a regulatory proceeding to develop a comprehensive program to reduce energy use in California's residential and commercial buildings. In 2009, the California Legislature adopted AB 758, which has similar provisions as the amended version of AB 2678.[51]

In 2007, California enacted legislation to require commercial buildings staring January 1, 2010 to benchmark energy use through the United States Environmental Protection Agency's Energy Star Portfolio Manager and to disclose this information to prospective buyer, lessee, or lender.[52]

Several cities and the European Union have adopted residential rating and disclosure policies. In November 2008, the City of Austin Texas adopted the Conservation and Disclosure Ordinance.[53] The policy, which took effect June 1, 2009, requires all commercial, residential or multi-family facilities to receive an energy audit if they are 10 years or older, receive services from the Austin Electric Utility, and are for sale, lease, or rent. Building owners must disclose the audit results to current and prospective tenant and buyers. For most consumers, efficiency retrofits remain voluntary; however, multi-family facilities that have an average per-square-foot energy usage exceeding 150% of the average for similar facilities within the Austin Electric Utility service territory are required to undergo mandatory energy efficiency upgrades.

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[48] City of Seattle Office of Sustainability and Environment Website, *available at* http://www.seattle.gov/environment/GBTaskforce.htm.

[49] *Id.*

[50] *See* the California Legislative Information Website, *available at* http://www.leginfo.ca.gov/cgi-bin/postquery?bill_number=ab_2678&sess=PREV&house=B&author=nunez.

[51] *See* the California Legislative Information Website *available at* http://www.leginfo.ca.gov/cgi-bin/postquery?bill_number=ab_758&sess=CUR&house=B&author=skinner (last visited 9-19-09).

[52] California Public Resources Code Section 25402.10, *available at* http://www.leginfo.ca.gov/cgi-bin/postquery?bill_number=ab_1103&sess=PREV&house=B&author=saldana. AB 531 was introduced in 2009 to exempt an electric or gas utility from existing customer information disclosure prohibitions when the electric or gas utility is uploading the energy consumption data for the account specified for a building to the US EPA's ENERGY STAR Portfolio Manager.

[53] Ordinance No. 20081106-0467, *available at* http://www.cityofaustin.org/edims/document.cfm?id=123737.

In April 2008, the Montgomery County, Maryland enacted a law to require sellers in single-family homes to disclose certain information about energy use.[54] Under the law, before signing a contract for the sale of a single-family home, the seller must provide the buyer with information about home energy efficiency improvements, including the benefit of conducting a home energy audit; and two copies of the electric, gas, and home heating oil bills or cost and usage history for the single-family home for the immediate prior 12 months.

In December 2002, the European Union adopted the Directive on the Energy Performance of Buildings. It required, among other things, that member states "ensure that, when buildings are constructed, sold or rented out, an energy performance certificate is made available to the owner or by the owner to the prospective buyer or tenant…."[55] Certificates are valid for ten years and must include benchmarks to allow consumers to compare and assess the energy performance.

Cost Considerations of Energy Rating and Disclosure Policies

There are several costs that residents or building owners must bear to comply with rating and disclosure policies, including fees to file with the local jurisdiction, costs of energy audits, and any ensuing upgrades. Cost estimates for an audit and accompanying report with recommendations range from $150-$700, depending on complexity and who conducts the audit.[56] Several possibilities exist to reduce the cost to the resident or building owner, such as capping the cost to comply with the policy. The City of Austin has enacted a policy to require rating and disclosure that caps audits at $300. Another option is to coordinate home energy audits with traditional home inspections. A significant portion of homes - up to 75% - are inspected as part of a sale.[57] Home inspectors could perform an audit or could collect requisite data that would then be analyzed by a qualified rating organization.

There also may be costs associated with any efficiency retrofits installed as a result of an audit and rating. Levels of energy savings and the associated costs would vary by home, but as a rule of thumb, in calculating the cost effectiveness for this policy, we assume that an the cost of an audit is $500 and that an efficiency improvement of 8% would cost $1,000.[58]

GHG Impact

It is unclear how much energy would be reduced by a rating and disclosure policy alone. It is likely that some building owners would execute recommended efficiency measures included in the audit report; however, it is unclear how many retrofits would occur. The effectiveness of a

[54] Montgomery County Code Chapter 40, real Property Section [[40-13A]] 40-13B.

[55] Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the Energy Performance of Buildings.

[56] *Id.*, City of Austin Energy Efficiency Upgrades Task Force Final Report p. 4. (Sept. 2008).

[57] California Energy Commission. Technical Assistance in Determining Options for Energy Efficiency in Existing Buildings -Final Report Appendices, P. A-39 (Dec. 2005). *See also*, GeoPraxis Time-of-Sale (TOS) Home Inspection Program Evaluation, prepared by Robert Mowris and Associates (2004), a*vailable at* www.calmac.org.

[58] This value is based in part on several sources: pro-rated estimates by Sustainable Spaces ($11,000 for $25% reduction in GHG emissions), Consol's estimate savings in the Berkeley RECO program (16%) and for deep retrofits ($10,000 for a 30% energy reduction), Berkeley's cost cap applied to San Diego (~$2,500), and San Francisco's RECO cost cap ($1,300). Average for 15% reduction is about $3,000. Taking only the Berkeley and San Francisco caps, the average cost would be about $1,900.

rating system could be increased when coupled with other programs and policies, such as required efficiency upgrades (Section 3.2.5).

The CEC estimates that a rating and disclosure program at the time of sale could reduce annual residential energy use on average by 535 kWh and 26 therms in California households.[59] To determine emissions reductions from this policy, we reduced these values slightly to reflect San Diego County's slightly lower electricity and natural gas consumption levels. Also, our estimates assume that 25% of audited homes would reduce total energy consumption by 8% total energy reduction, though it may be possible to increase these numbers with customer education. Nonetheless, based on our assumptions, GHG savings would be 0.03 MMT CO_2E if a policy were applied to all residential buildings at the time of sale and 0.02 MMT CO_2E if applied only to buildings built in 1980 or earlier (Table 9). A policy required at time of sale in San Diego County would capture about 3.5% of homes annually and assuming homes only sell once, it would take 30 years to capture all homes. If it were possible to capture more homes annually by having more trigger points for audits total GHG reductions would increase and occur faster.

Table 9 GHG Reductions from Rating and Disclosure Policy (San Diego County, 2020)

Building Population	GHG Reduction (MMT CO2E)	% of ITRON Existing Residential Total	% of EPIC Energy Reduction Target
All Buildings	0.03	16%	3%
Pre 1980	0.02	9%	2%

Policy Considerations

There are several key options that must be considered when developing a rating and disclosure policy.

Rating System. One of the most important aspects is the rating system used to measure energy performance. Several systems exist, including the California version of the Home Energy Rating System and Energy Star for Home Performance. The CEC was required by legislation to establish regulations for a Home Energy Rating System (HERS) Program to certify home energy rating services in California.[60]

Trigger Points. When to require an audit is another important consideration. Trigger points should be sufficient to cycle through the building stock in a reasonable timeframe. Options for trigger point include the time-of-sale. Homeowners would be required to conduct and audit and disclose to potential buyers the energy performance of the home for sale. Another approach would be to require audits by a specific date, which can more systematically cycle through all homes in a jurisdiction. For example, a policy could require homes built in a certain year or range of years to conduct audits within a specified timeline. A similar option would put an expiration date on the energy rating certificate (e.g., 10 years), so homes would have to be audited in regular intervals, depending on the level of efficiency retrofits completed. Other

[59] California Energy Commission, Options for Energy Efficiency in Existing Buildings, p.54 (Dec. 2005).

[60] Public Resource Code Section 25942. See also California Code of Regulations, Title 20, Chapter 4, Article 8, Sections 1670 to 1675.

possible trigger points include rental, lease, other transfers, major retrofits, new electrical accounts, and reappraisals. Each of these would increase the total number of residential units captured by the policy.

Buildings Covered. Which buildings are covered by or exempt from rating and disclosure policies is an important policy choice. Since building codes began in 1978 in California, one option is to limit the policy to buildings built before 1980 or some other date. Austin's policy captures buildings older than 10 years. The CEC proposed a phased approach beginning with a pilot, followed by the first phase in which audits were mandatory only for pre-1980 buildings, and the second phase in which all residential units were required to receive an audit.[61] In addition, exemptions for historic buildings, mobile homes, and homes that have already participated in energy reduction programs should be considered.

Enforcement. How a policy is enforced and penalties for non-compliance are other important issues. As mentioned above, the City of Austin fines residents between $500 and $2,000 for building owners who do not comply with the ordinance.

Advantages and Disadvantages of Rating and Disclosure Policies

Rating and disclosure policies have several advantages. By requiring residential building owners to disclose the energy performance to renters, buyers, and lessors, such policies can increase awareness of building energy performance and could encourage energy efficiency retrofits. Also, once in place, the energy rating systems used for a rating and disclosure policy could be the basis for future requirements for energy efficiency retrofit policies (see 3.2.5 below). Because several energy rating systems exist, including California's Home Energy Rating System, local governments would not have to develop such systems in order to require rating and disclosure.

Rating and disclosure policies also have several disadvantages. Although building owners would be required to disclose energy performance, absent a requirement to increase buildings efficiency there is no guarantee that building owners, renters, or lessors would conduct efficiency retrofits; therefore, it is not clear how much energy and GHG reduction would result from adopting such a policy. A rating and disclosure policy would require a significant number of qualified home energy raters and building performance contractors and other businesses required to conduct retrofits, which currently do not exist. Unless the number of qualified building energy auditors increases, it could be difficult to scale up to significant penetrations of existing buildings in the region. Finally, opposition from stakeholders, particularly the real estate community if a policy uses time of sale as a trigger point, could make adoption of such policies difficult.

3.2.5. Efficiency Retrofit Policies

Efficiency retrofit polices, sometimes called "energy conservation ordinances," require building owners to conduct energy efficiency retrofits at defined trigger points. Examples of these policies include Residential Energy Conservation Ordinances (RECO) and Commercial Energy Conservation Ordinances (CECO). These policies are analogous to policies adopted to increase water efficiency. For example, the City of San Diego Municipal Code (SDMC) 147.04 requires all buildings to install water-conserving plumbing fixtures prior to a change in property

[61] California Energy Commission. Options for Energy Efficiency in Existing Buildings (Dec. 2008).

ownership.[62] City of San Francisco Housing Code Chapter 21A also contains a similar requirement. An overview of existing efficiency upgrade policies is presented below followed by more detailed discussion of the elements of such policies.

Overview of Existing Efficiency Retrofit Policies

The City of San Francisco adopted a Residential Energy Conservation Ordinance in 1982. It requires certain residential property owners constructed before 1978 to make prescribed energy and water efficiency upgrades prior to sale of the property. Owners of single- and two-family dwellings, apartment buildings, and residential hotels must comply at the time of sale. Conversion of a unit from the master meter to an individual meter, major renovation, and condominium conversions also must comply as part of the city approval process. To comply with the RECO, residential property owners who plan to sell their property, must obtain a valid energy inspection, install certain energy and water conservation measures and then obtain a certificate of compliance. Completion of this procedure must occur prior to transfer of title and the seller must provide a copy of the compliance certificate to the buyer prior to title transfer.[63]

The City of Berkeley enacted its RECO in 1987 and a similar Commercial Energy Conservation Ordinance in 1994. Like San Francisco's policy, Berkeley's RECO requires residential property owners that seek to sell, exchange, or substantially renovate their facility to install the required energy efficiency measures (up to cost caps), receive an inspection, and provide a copy of the compliance certification to prospective buyers or in the case of a renovation project, submit a copy to the City's Building Department.[64]

Under Berkeley's CECO, whenever a building is sold, transferred, or undergoes a major renovation, the building owner or responsible party must obtain an energy audit for the building for the purpose of ascertaining the costs and energy savings of each required energy conservation measures, submit the audit findings with proper city department, install all required energy efficiency, obtain a final energy inspection, and file the results with city to demonstrate compliance.

As noted above, the City of Austin has adopted a rating and disclosure policy. Most buildings are not required to install energy efficiency measures; however, in certain cases, owners of all multi-family facilities that are ten years old or older must have an energy audit performed and install efficiency measures. The owner must post and provide to current and prospective tenants the results of the audit in a manner prescribed by rule, and must provide a copy to the director of the Austin Electric Utility within 30 days of its completion. Regardless of age of the building, the director can designate certain facilities as "High Energy Use" if it has an average per-square-foot energy usage exceeding 150% if of the service area average. Owners of these facilities must implement enough efficiency measures to bring it within 110% of service area average within 18 months.[65]

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[62] City of San Diego Plumbing Retrofit Ordinance Compliance, *available at,* http://www.sandiego.gov/water/conservation/selling.shtml.

[63] San Francisco Department of Building Inspection, What You Should Know About the Residential Energy Conservation Ordinance (RECO). November 2007, a*vailable at*, http://www.sfgov.org/site/uploadedfiles/dbi/Key_Information/19_ResidEnergyConsBk1107v5.pdf.

[64] Berkeley Municipal Code Chapter 19.16 §19.16.070.

[65] Austin Municipal Code Chapter 6-7 §6-7-21 et seq.

In 1997, the City of Burlington, VT enacted its Minimum Rental Housing Energy Efficiency Standards Ordinance, which seeks to improve the efficiency of rental housing. It requires that "[u]pon transfer of rental property where there is a deed recorded, an inspection report, signed by a Vermont-licensed mechanical engineer or an inspector certified by the program administrator, must be filed with the city clerk when the deed is recorded in the land records. The inspection report shall either include a certificate of energy efficiency compliance, if the standards of this article are met, or list the standards not met and inform the property owner that the recruited energy improvements must be made within one year of the date of transfer."[66]

The State of Wisconsin adopted its Rental Weatherization Program in 1985, which requires efficiency upgrades in rental properties. Under the policy, a property owner must obtain an inspection by a certified inspector or the Department of Commerce to determine whether the rental unit meets the energy efficiency requirements of the rule. If the property meets the requirements, the inspector issues the owner a certificate of compliance and file a copy with the Department within 15 days. If the property fails, the inspector must notify the owner within 10 days of the reason, defects, and measures required to comply. The owner must then bring the property into compliance (within 1 year if a purchaser "stipulation" applies) and obtain a final re-inspection inspection. Once the owner is given a certificate of compliance (or waiver, stipulation, etc), he must then present it as a precondition of recordation at the time the deed transfer is recorded with the register.[67]

New York City is also considering a policy to require efficiency retrofits in certain buildings.[68] INT 0967-2009 would require buildings over 50,000 gross square feet is required to perform an energy audit and make all retro-commissioning and efficiency retrofit upgrades that have a simple payback of 7 years.

Cost Considerations of Efficiency Retrofit Policies

Efficiency retrofit policies typically include several costs to residents or building owners, including filing fees, inspection fees, and the cost of making the efficiency upgrades. The City of Berkeley Residential Energy Conservation Program (RECO) has a $20 filing fee, $150 in inspection fees, and caps the cost of efficiency upgrades at 1-2 family facilities at 0.75% of the final sale price and $0.50 per square foot when any one structure with three or more housing units is sold. Renovation projects, which are triggered for projects that cost more than $50,000, are capped at 1% of project costs. In addition to these caps, the Berkeley RECO provides for the right to appeal if the resident believes that complying with the ordinance would be unreasonable.[69] Assuming San Diego's median residential housing value is $325,000, the cap for 1-2 family facilities would be $2,500. The City of San Francisco's RECO program also

[66] City of Burlington Code of Ordinances Article VII, Sec 18-503.

[67] Wisconsin Administrative Code, Department of Commerce. Chapter Comm 67 Subchapter III, §Comm 67.05 et seq.

[68] INT 0967-2009. The New York City Council Web Site *available at* http://webdocs.nyccouncil.info/textfiles/Int%200967-2009.htm?CFID=381204&CFTOKEN=24968752.

[69] City of Berkeley. Residential Energy Conservation Ordinance (RECO): A Compliance Guide for Berkeley's Residential Property Owners and Sellers. July 2008. *Available at* http://www.ci.berkeley.ca.us/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/Residential%20Energy%20Conservation%20Ordinance%20Compliance%20Guide%202008.pdf.

requires facility owners to pay the cost of inspection and fees related to the program.[70] Program compliance costs are capped at the greater of 1% of the purchase price or 1% of the assessed value for buildings that contain 3 units or more. In the case of single 1 and 2 family units, the cap is $1,300.[71]

The City of Berkeley's Commercial Energy Conservation Ordinance also has cost caps. In the case of facilities that enter the program due to sale, the cap is the lesser of 1% of the value or $150,000. In the case of renovation, the cap is the lesser of 5% of the cost of the renovation or 1% of the value of the facility.

The City of Burlington's policy provides for cost caps for efficiency measures. The ordinance states that "no property owner shall be required to make any specific energy improvement where the cost of making the improvement is greater than seven times the calculated first year savings in energy costs attributable to the improvement."[72] In addition, the cost of energy improvements required under this the policy cannot exceed the lesser of 3% of the sale price of the property or $1,300 per rental unit.[73]

The state of Wisconsin program sets cost caps for inspections at $250. For facilities with 3-8 Rental units the cap is $50 for each additional unit over 2, and for facilities over 8 rental units, $25 for each additional unit after 8.

Cost estimates vary for comprehensive residential retrofit projects. On the lower end of the range, the City of San Francisco's RECO program has a cost cap of $1,300 and has reduced energy use by 10% on average. Achieving higher energy reductions could cost significantly more. For example, upgrading an air conditioner, furnace, sealing ducts, and increasing ceiling insulation to reduce overall energy use by 30% could cost more than $10,000. For our preliminary cost effectiveness calculations, we assume $2,500 for a 15% reduction.[74] This value is based on the assumption that it is less expensive to reduce lower amounts of energy than it would be for a deep retrofit yielding significant savings.

To determine average commercial retrofit implementation costs, we analyzed actual project cost data from SDG&E's Standard Performance Contract Program.[75] Based on data from 2006-2007, the average cost for energy reductions (including lighting, HVAC, and other measures) is $0.75 per kilowatt-hour and $4.35 per therm, which would be equivalent to $1.22 per square foot when combined and applied to the estimated energy reductions in the region. To be conservative, our projected energy savings associated with a commercial efficiency retrofit policy are based on an average cost of $1.50 per square foot.

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[70] Except for condo conversions in which case the inspection will be performed in conjunction with the total conversion inspection already required.

[71] San Francisco Housing Code Chapter 12 §1209.

[72] City of Burlington Code of Ordinances Article VII Sec 18-503.

[73] *Id.*

[74] This value is based on several sources: pro-rated estimates by Sustainable Spaces ($11,000 for $25% reduction in GHG emissions), Consol's estimate savings in the Berkeley RECO program (16%) and for deep retrofits ($10,000 for a 30% energy reduction), Berkeley's cost cap applied to San Diego (~$2,500), and San Francisco's RECO cost cap ($1,300). Average for 15% reduction is about $3,000. Taking only the Berkeley and San Francisco caps, the average cost would be about $1,900.

[75] San Diego Gas & Electric 2008 Energy Efficiency Quarterly Report for Standard Performance Program (SPC) *available at* http://www.sdge.com/regulatory/energyEfficiency.shtml.

GHG Impact of Efficiency Retrofit Policies

The overall GHG reduction impact from an efficiency upgrade policy depends largely on three factors: the number of buildings that are captured each year by the policy, the energy upgrades required, and the cap on efficiency upgrade costs. Estimates vary about how much energy such a policy would reduce. The City of Berkeley estimates that energy savings from their RECO program range from 10-20% per building.[76] Another estimate of the Berkeley RECO program estimates savings at 16%, just about in the middle of Berkeley's estimate.[77] Assuming an annual penetration rate of 2% and that each residential unit reduces its energy consumption by 15%, a residential efficiency upgrade policy in the San Diego region would reduce GHG emissions by 0.14 MMT CO_2E if applied to all 2010 buildings and 0.09 MMT CO_2E if applied only those built prior to 1980. Table 10 shows the emissions reductions for efficiency retrofit policies and how they compare to Itron's estimate for energy reductions from existing residential and the revised EPIC energy reduction target.

Another important factor in estimating emissions reductions from energy efficiency policies is the GHG intensity of electricity. Assuming implementation of a renewable portfolio that requires electric utilities to provide 33% renewable energy by 2020, the GHG content of electricity would decline over time, therefore reducing the GHG impact of energy efficiency. For purposes of estimating GHG emissions reductions associated with energy efficiency policies, we have assumed that all the reduction strategies contained in the San Diego County Greenhouse Gas Inventory report are implemented and that the GHG intensity of electricity declines steadily between now and 2020.

Table 10 GHG Reductions from Residential Efficiency Upgrade Policy, San Diego County (2020)

Building Population	GHG Reduction (MMT CO2E)	% of ITRON Existing Residential Total	% EPIC GHG Reduction Target
All Buildings	0.14	71%	15%
Pre 1980	0.08	41%	9%

A commercial program could have significant GHG reductions. Berkeley estimates that their CECO program on average reduces energy usage 10-15%. Assuming a 2% annual penetration rate and a 15% average electricity savings per facility, a similar program in the San Diego region would reduce GHG emissions by 0.14 MMT CO_2E if applied to all buildings and 0.04 MMT CO_2E if applied to pre-1980 buildings by 2020 (Table 11). The level of energy savings and emissions reductions from a policy that would target all commercial buildings is higher than the estimated mid-range potential identified by Itron.

[76] City of Berkeley, Climate Action Plan April 2009 (3rd DRAFT), p. 51.

[77] Consol, Meeting AB 32 – Cost-Effective Green House Gas Reductions in the Residential Sector, p. 10 (Aug. 2008).

Table 11 GHG Reductions from Commercial Efficiency Upgrade Policy, San Diego County (2020)

Building Population	GHG Reduction (MMT CO2E)	% of ITRON Existing Commercial Total	% EPIC GHG Reduction Target
All Buildings	0.14	142%	15%
Pre 1980	0.04	45%	5%

Policy Considerations

Trigger Point. Like audit and disclosure policies, what actions trigger the requirements of an energy efficiency upgrade policy is an important consideration. The City Berkeley RECO Program requires compliance upon sale, transfer, renovation that cost more than $50,000, and participation in Berkeley First Program, which provides financing for solar photovoltaics projects. Trigger points are the same for the CECO program with the exception that renovation projects that increase total heated or cooled square footage by more than 10% must also comply with the program requirements.[78]

San Francisco's RECO requires efficiency retrofits at the following triggers points: sale, meter conversion (moving one or more units from a master meter to an individual meter), condominium conversions, and major improvements. In the case of major improvements, for 1 and 2 family units the cost of improvements must be greater than $6,000, for facilities of 3 or more units the improvements must be greater than $6,000 per unit, and for residential hotels $1,300 per unit. Other possible trigger points include lease, property tax assessments, and date certain, which would require certain buildings to meet efficiency upgrade requirements by a specific date. Another approach is to have assessments in regular time intervals, such as every 10 years.

Prescriptive vs. Performance. Whether efficiency upgrade measures should be prescriptive or performance-based is another important consideration. Berkeley's RECO Program currently is prescriptive, requiring residents to complete a predetermined list of actions (Table 12) within the cost caps provided.

[78] Berkeley Municipal Code Chapter 19.72 Section 19.72.020.

Table 12 List of Prescriptive Measures from the City of Berkeley RECO Program

Toilets	1.6 gal/flush, or flow reduction devices
Showerheads	3.0 gal./minute flow rate.*
Faucet aerators	2.75 gal./minute flow rate for kitchens and bathrooms.*
Water heater blankets	Insulation wrap of R-12 value
Hot & Cold Water Piping	Insulate the first two feet from the heater to R-3 value
Hot Water Piping in Pumped, Re-circulating Heating Systems	Insulate all pipes to R-3 value
Exterior Door Weatherstripping	Permanently affix weather stripping, and door sweeps or door shoes
Furnace duct work	Seal duct joints add insulation wrap to R-3 value
Fireplace chimneys	Must have dampers, doors or closures
Ceiling insulation	Insulate to R-30 value or greater
Common Area Lighting (multi-unit buildings)	Replace incandescent bulbs with compact fluorescent lamps (CFL) of at least 25 lumens. CFLs will save up to 75% per year of the lighting portion of your electricity costs. A 20-watt CFL is equivalent to a 75-watt incandescent bulb in output. Use a CFL that is 1/4 the watts of the bulb you are replacing to keep the light levels the same.

*Available free from East Bay Municipal Utility District

An alternative to this approach is to make the requirements performance-based. Under this approach, facilities would have to reach a required level of efficiency and the building owner would have some level of flexibility to determine the most cost effective way to achieve those levels. Establishing a standard rating system is required for this approach. As discussed in the section above on rating and disclosure, the California Home Energy Rating System is a possible standard to rate the efficiency of existing residential units and to establish targets for compliance. For commercial buildings, Energy Star Portfolio Manager could be used to assess efficiency and set targets.

Enforcement. Enforcing compliance is essential to the success of energy efficiency upgrade policies. Ultimately enforcement depends on the structure of the policy. For example, enforcement measures for a prescriptive program will differ from those used in a performance program. In most cases, final compliance documents must be filed with a relevant city department and permits or recording of property transfer can be withheld if a property is not in compliance. In addition, some jurisdictions levy fines for violating the efficiency upgrade requirement. For example the City of Berkeley RECO program and Wisconsin Rental Weatherization Program fine property owners who do no comply up to $500.[79]

Transferability of Obligation. Some efficiency retrofit policies allow the building owner to transfer the obligation to the purchaser. For example the Berkeley RECO and CECO programs

[79] Berkeley Municipal Code Chapter 1.20 Section 1.20.020 and Wisconsin Administrative Code Dept of Commerce Chapter Comm 67, Subchapter III, Section Comm 67.08.

and the Wisconsin Rental Weatherization Program allow compliance to be passed to the buyer.[80]

Buildings Covered. Berkeley's policy requires both residential and commercial buildings to increase efficiency at the time of sale. San Francisco's policy only requires residential buildings to comply. The age of the building is another possible consideration. Since building standards were not adopted until 1979, limiting buildings built before 1980 could be a way to phase in such a policy. The size of the building can also be a policy criterion, particularly for commercial buildings.

The following residential buildings are exempt from San Francisco's RECO: any residential building for which proof of compliance has been properly recorded; any residential building constructed on or after July 1, 1978; any mobile home; any residential building or portion thereof, which is occupied as a hotel or motel unit and which has a certificate of use for tourist occupancy; any portion of a residential building converted to a tourist hotel; and, any building or portion thereof which is a live/work. In addition, title transfers that result from an operation of law, such as such as probate, transfer between family members, and foreclosure are also exempt from RECO.[81]

Other exemptions exist in other policies. For example, the City of Austin's upgrade requirement for multi-family buildings exempts buildings owners that have completed certain energy efficiency upgrades, such as HVAC or duct remediation, through participation in an Austin Electric Utility rebate program within the last ten years.[82] Burlington exempts from its rental efficiency ordinance owner-occupied portions of a multi-unit building; rental properties not rented in winter months; new construction projects subject to and in compliance with the current energy construction standards; hotels, motels, tourist rooming houses, dormitories, hospitals, hospices and nursing homes; buildings or apartments where heating costs are paid by owners of the rental properties; and transfers such as those related to inheritance, divorce, foreclosures, bankruptcies, condemnations and tax sales.[83]

Climate Zone. Buildings located in hotter climate zones may be able to reduce energy more cost effectively than coastal communities. Efficiency retrofit policies may be most effective in hotter, inland climates and communities that span more than one climate zone might consider targeting the hotter climate zones first.

Spending Cap. Both the Berkeley and San Francisco policies provide for a spending cap that limits the amount of money a resident must spend to comply. The caps can be established as a specific dollar amount or a percentage of the property value or renovation costs.

Integration with Other Policies. Local governments should consider how related energy policies interact. For example, the City of Berkeley has a finance program for solar photovoltaics that requires participants to have met the requirements of the RECO program to be eligible.

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[80] Berkeley Municipal Code Chapter 19.16 Section 19.16.080 and Chapter 19.72 Section 19.72.110.

[81] San Francisco Housing Code Chapter 12 Section 1208.

[82] Austin Municipal Code Chapter 6-7 § 6-7-24 Exemptions.

[83] Burlington Code of Ordinances Chapter Article VII Sec. 18-502.

Advantages and Disadvantages of Efficiency Retrofit Policies

Requiring existing buildings to increase efficiency has one main advantage: unlike the rating and disclosure policy discussed above, an efficiency retrofit policy would guarantee a certain level of energy and GHG emissions reductions. And because existing buildings in the residential and commercial sectors hold the highest potential for energy savings in the region, an efficiency retrofit policy could yield significant GHG emissions reductions. In general efficiency retrofits are cost effective. Commercial efficiency retrofits had among the lowest cost of GHG reduction of all the policies we evaluated here. Residential efficiency retrofits had a medium cost but the highest potential for GHG reductions. Also, because there are several long standing efficiency retrofit policies in California, policy development would be relatively easy.

Perhaps the biggest disadvantage to such a policy at this time is the insufficient number of qualified energy auditors and retrofit companies in the region. A required efficiency retrofit policy would require a significant increase in the number of auditors and retrofit professionals. Also, an efficiency retrofit policy would require more administrative start up and cost than a rating and disclosure policy. If a rating and disclosure policy is adopted first, it might be easier to implement an efficiency retrofit policy, since the rating infrastructure and procedures would already be in place. The real estate and commercial building owner and manager communities could oppose a required efficiency retrofit policy.

3.2.6. Retro-Commissioning of Commercial Buildings

"Building commissioning is a systematic process of ensuring that a building performs in accordance with the design intent, contract documents, and the owner's operational needs."[84] Commissioning can occur at any or all three phases of building's life-cycle. Initial commissioning applies to new buildings and involves subjecting the structure to an intensive quality assurance process that beings with construction and continues into the building's operational period. Retro-commissioning applies to existing buildings and involves improving the way building elements function together and the buildings operations and maintenance practices. Re-commissioning applies to previously commissioned buildings that require re-verification due to some triggering event such as change in building use or similar transition.[85]

This section focuses on retro-commissioning. According to the CEC, retro-commissioning is the process of "systematically investigat[ing] the operation of a building's energy consuming equipment to detect, diagnose, and correct faults in the installation and operation of commercial building energy systems."[86] A proposed New York City policy defines retro-commissioning measures as "non-capital work such as repairs, maintenance, adjustments, changes to controls or operational improvements that optimize a building's energy performance, and that have been

[84] Monitoring-Based Commissioning: Benchmarking Analysis of 24 UC/CSU/IOU Projects. Lawrence Berkeley National Laboratory Report (LBNL-1972E) (June 2009).

[85] Mills, E., H. Friedman, T. Powell, N. Bourassa, D. Claridge, T. Haasl, and M.A. Piette. 2004. "The Cost-Effectiveness of Commercial Buildings Commissioning: A Meta-Analysis of Existing Buildings and New Construction in the United States." Lawrence Berkeley National Laboratory Report No. 5663.

[86] California Energy Commission, Options for Energy Efficiency in Existing Buildings, p.viii (Dec. 2005).

identified by a systematic process of investigating and analyzing the performance of a building's equipment and systems that impact energy consumption."[87]

Experience of Other Jurisdictions

The New York City Council is considering a policy that would, among other things, require retro-commissioning in large buildings. [88] Under the proposed policy, buildings that are 50,000 gross square feet or larger and multiple buildings on the same lot that exceed 50,000 gross square feet, would be required to receive an audit to identify all reasonable retro-commissioning and retrofit measures. A building owner would be required to complete all retro-commissioning measures identified that have a simple payback of 7 years or less. Certain exemptions apply for buildings that have demonstrated an acceptable level of efficiency or are LEED certified and in cases where the actual installation of a measure contained in the audit report exceeds the projected cost by more than 20% and increasing the simple payback beyond the 7-year maximum.

Cost Considerations of Retro-Commissioning Policies

A 2004 Lawrence Berkeley National Laboratories (LBNL) report on the cost effectiveness of retro-commissioning estimated that implementation costs of those projects surveyed average $0.41 per square foot.[89] The study also found that on average retro-commissioning projects reduced energy use by 15% and had a simple payback of 8.5 months. More energy-intensive buildings, such as laboratories, had a 2.5-year payback. A 2005 CEC report estimated costs at $0.68 per square foot.[90] To be conservative, for purposes of calculating preliminary cost effectiveness levels, we assume a rate of $0.55, a blend of these two estimates. Retro-commissioning is among the most cost effective policies that we evaluated in this report.

GHG Impact of Retro-Commissioning Policies

The CEC estimates that retro-commissioning could reduce energy use annually by 1.5 kWh and 0.07 therms per square foot of commercial building space.[91] Given San Diego's climate and slightly lower average gas and electric use compared to the state as a whole, to estimate GHG emissions reductions, we used savings rates of 1.3 kWh and 0.03 therms per square foot. We assume, based on estimates by the CEC, that about 2% of the buildings each year could be retro-commissioned.

Based on these assumptions, we estimate that a retro-commissioning policy would reduce GHG emissions by 0.08 MMT CO_2E and 0.02 MMT CO_2E if applied to all buildings and pre-1980 buildings, respectively. Table 13 presents the potential GHG reductions associated with a retro-

[87] Int 967-2009. The New York City Council Website *available at* http://webdocs.nyccouncil.info/textfiles/Int%200967-2009.htm?CFID=381204&CFTOKEN=24968752.

[88] *Id.*

[89] Mills, E., H. Friedman, T. Powell, N. Bourassa, D. Claridge, T. Haasl, and M.A. Piette. 2004. "The Cost-Effectiveness of Commercial Buildings Commissioning: A Meta-Analysis of Existing Buildings and New Construction in the United States." Lawrence Berkeley National Laboratory Report No. 5663.

[90] California Energy Commission, Options for Energy Efficiency in Existing Buildings, p.67 (Dec. 2005).

[91] California Energy Commission, California Energy Commission, Options for Energy Efficiency in Existing Buildings, p.67 (Dec. 2005).

commissioning program and its relation to the Itron potential for existing commercial buildings and the adjusted EPIC GHG reduction target for electric and natural gas efficiency.

Table 13 GHG Reductions from a Commercial Retro-Commissioning Policy, San Diego County (2020)

Building Population	GHG Reduction (MMT CO2E)	% of ITRON Existing Commercial Total	% EPIC GHG Reduction Target
All Buildings	0.08	75%	8%
Pre 1980	0.02	24%	3%

Policy Considerations

The considerations for developing a retro-commissioning policy are similar to those discussed above for auditing and disclosure and retrofit policies.

Trigger Point. There is a range of options to establish the point at which a building owner would be required to comply with a retro-commissioning policy. Similar to the existing building policy options above, these include, time of sale, time of lease, date certain, or a rolling requirement that would require buildings to have their facilities commissioned after a given number of years.

Buildings Covered. Retro-commissioning is typically intended for commercial buildings. Buildings covered by a policy could be based on age and buildings size, and measured in square feet. As mentioned above, New York City's proposed policy would require retro-commissioning for buildings that are 50,000 square feet or larger and 10 years old or older.

Compliance Cost Cap. Similar to auditing and disclosure and retrofit policies, a retro-commissioning policy could include a limit on the cost to comply. New York City's proposed policy would set a maximum payback limit at 7 years. Other options would be to establish a dollar amount calculated as a percentage of the value of the buildings, as is done in the Berkeley CECO program, which has a compliance cost cap of the lesser of 1% of the value or $150,000.

Integration with Other Policies. The proposed New York City retro-commissioning policy is part of a broader policy to reduce energy use in existing buildings that requires audits and retrofit measures.

Advantages and Disadvantages of Retro-Commissioning Policies

The most significant advantage of a commercial retro-commissioning policy is cost effectiveness. Retro-commissioning had among the lowest GHG abatement cost of the policies evaluated here. If a policy were targeted to all existing buildings, it could yield moderate GHG reduction. Also, retro-commissioning is an established practice and there is a developed retro-commissioning infrastructure in the region, including incentive programs offered by San Diego Gas & Electric.

One drawback to adopting such a policy is that none currently exist in the U.S., which could add to policy development and start up costs. If a retro-commissioning policy only targeted buildings built prior to 1980, it would only deliver a low level of GHG emissions reductions. In

addition, any requirement on existing commercial buildings could engender opposition from the commercial building owner and management communities.

3.2.7. Solar Water Heating Retrofits

While no cities in the U.S. have adopted a policy to require residential solar water heating retrofits, examples exist from other regions of the world. As an example, in July 1999, Barcelona, Spain adopted a policy requiring that solar hot water systems supply a portion of the overall hot water supply of certain buildings.[92] Barcelona's Solar Thermal Ordinance applies to new construction, major rehabilitations, buildings seeking a change of use that have an annual average forecasted hot water need greater than 276,000 net British Thermal Units (BTU) or 2.8 therms.[93]

A policy to encourage or require solar water heating could significantly reduce GHGs in the region. Assuming that 10% of all residential units installed solar water heaters by 2020, annual energy savings is 117 for systems that offset natural gas therms and 2,700 kWh for electricity, and that 60% of retrofits offset natural gas and 40% offset an electricity, total emission reductions would be 0.09 MMT CO_2E, if applied to a percentage of all buildings.[94] If applied as a percentage of pre-1980 buildings, total emissions savings would be 0.05 MMT CO_2E. Estimated solar water heating implementation costs, based on data from the CSI Solar Water Heating Pilot Program, are slightly below average among the policies we evaluated – greater than residential efficiency retrofits but less than photovoltaics requirements.

3.2.8. Summary of Findings for Existing Building Policies

Given the current building stock and future trends, it is very likely that a significant proportion of building that will be in place in 2050 already exists today. Improving the energy efficiency of existing residential and commercial buildings has the greatest potential among the policies assessed to reduce energy and GHG emissions in the region. Residential and commercial retrofits have the greatest potential to reduce GHG emissions among the policies evaluated here. Figure 7 presents estimates of emissions reductions for the all-buildings and pre-1980 building scenarios. Four policies have high potential to reduce GHG emissions[95]: residential efficiency retrofits in all buildings, commercial efficiency retrofits in all buildings, residential efficiency retrofits in pre-1980 buildings, and commercial retrofits in all buildings. Two policies, commercial efficiency retrofits and retro-commissioning, have both a low cost per metric ton of CO_2E reduction and high potential to reduce GHG emissions, depending on how many buildings are targeted by the policy. Residential efficiency retrofits have a medium cost of implementation. None of the policies with a high potential to reduce GHG emissions had a high cost. A summary of the GHG reduction potential and cost of implementation are presented in Table 14, which is sorted by potential to reduce GHG emissions.

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[92] For a copy of the ordinance, see the Barcelona Energy Agency Website, *available at,* http://www.barcelonaenergia.cat/document/OST_Explicac_eng.pdf (last visited June 20, 2009); *See also* http://www.barcelonaenergia.cat/eng/operations/ost.htm (last visited June 30, 2009).

[93] City of Barcelona, Spain. Ordinance on the Incorporation of Solar Therms Energy Collection in Buildings. Article 2 (c).

[94] Energy reduction estimates and percentage of natural gas and electric systems from CSI-Thermal Program: Energy Division Staff Proposal for Solar Water Heating Program, issued in Rulemaking 08-03-008, *available at* http://docs.cpuc.ca.gov/efile/RULINGS/104403.pdf.

[95] *See* Section 7.5 in the Appendix for more information the GHG reduction potential and implementation cost categories.

Residential energy rating and disclosure is the only policy intended for existing buildings that has a low potential to reduce GHG. It also has a high cost in part because only a fraction of the homes audited were assumed to have conducted efficiency improvements. Despite its emissions reduction potential and cost profile, this policy could help to raise awareness about building energy performance and provide the framework for future efficiency retrofit requirements.

Figure 7 Greenhouse Gas Emission Reduction Estimates for Existing Building Policies (2020)

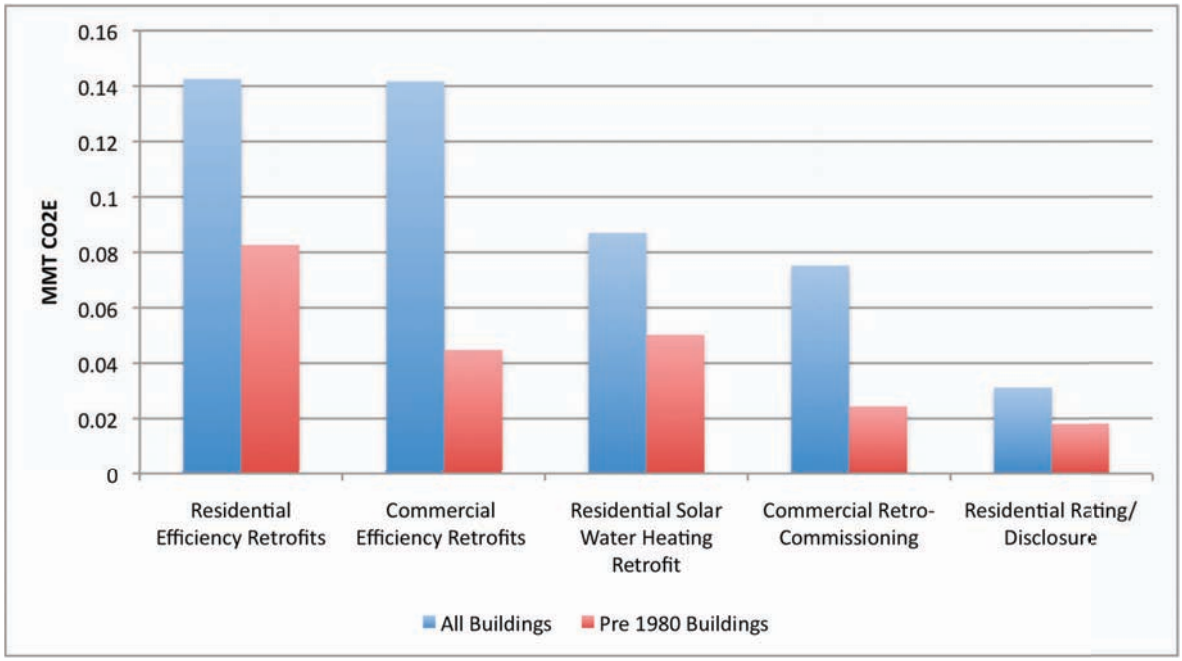


Table 14 Summary of GHG Reduction Potential and Cost for Existing Building Policies (Medium Scenario 2020)

GHG Reduction Policy Option	GHG Reduction Potential[1] (MMT CO_2E)	Cost per Unit of GHG Reduction[1] ($/MT CO_2E)
Residential Efficiency Retrofits (ALL)[2]	H	M
Commercial Efficiency Retrofits (ALL)	H	L
Residential Solar Water Heating Retrofit (ALL)	H	M
Residential Efficiency Retrofits (Pre-1980)[3]	H	M
Commercial Retro-Commissioning (ALL)	M	L
Residential Solar Water Heating Retrofit (Pre-1980)	M	M
Commercial Efficiency Retrofits (Pre-1980)	M	L
Residential Rating/Disclosure (ALL)	M	H
Commercial Retro-Commissioning (Pre-1980)	L	L
Residential Rating/Disclosure (Pre-1980)	L	H
Residential Pre-Plumb (New)	L	H

[1] L=Low M=Medium H=High

[2] "All" means policy targets a percentage of all buildings.

[3] "Pre-1980" means policy targets a percentage of buildings built before 1980.

3.3. Policy Options for Reducing Energy in New Construction

In the San Diego region, new homes account for about 1% of the total building stock annually and therefore hold significantly less potential for GHG reductions than the existing building sector. Of the total energy efficiency *program* potential remaining in San Diego, less than 1% is expected to come from residential new construction and 6% from commercial new construction.[96] This estimate, taken from the Itron efficiency potential study, only represents the remaining potential from programs such as those managed by the local utility and belie the potential savings from future new construction and appliance standards; however, this report focuses on areas that local governments have direct jurisdiction over, such as local codes and standards, permitting, and zoning, and areas that they have some influence over. The new construction policies evaluated below are presented in Table 15 along with examples of jurisdictions that have adopted similar policies.

[96] Itron, Inc., California Energy Efficiency Potential Study- CALMAC Study ID: PGE0264.01, (Sept. 2008).

Table 15 New Construction Policies

POLICY OR MEASURE	JURISDICTIONS THAT HAVE ADOPTED THE POLICY OR MEASURE
Enhanced New Construction Building Energy Standards	San Francisco (CA), City of Santa Barbara (CA), Palm Desert (CA), Marin County (CA), 10 other CA Cities
Energy Efficiency Appliances	Santa Barbara (CA)
Energy Rating and Disclosure	Kansas, South Dakota
Pre-Plumb for Solar Water Heating	Chula Vista (CA), Carlsbad (CA)

3.3.1. Enhanced New Construction Building Energy Standards

California's Building Energy Efficiency Standards comprise the provisions of California Code of Regulations, Title 24, Part 1, Ch. 10 (California Building Standards Administrative Code) and Title 24, Part 6 (California Energy Code). The Chapter 10 provisions set forth the governing regulations relevant to Part 6, which actually contains the substantive provisions pertaining to building energy performance and standards. The California Energy Code, which sets energy efficiency standards for residential and nonresidential buildings, is administered by the CEC and updated periodically to incorporate new technology, methods, and legislative mandates. Title 24 is published triennially and enforced at the state level by the by the Building Standards Commission; however, enforcement is delegated to the local government agency in charge of overseeing building permitting and construction within each jurisdiction.

CA law permits local governments to adopt mandatory building energy standards that exceed California's Title 24. Since building energy standards in California are developed at the state level, a local government must obtain official approval before imposing more stringent standards within its jurisdiction. The procedure for obtaining such approval is set forth by Public Resources Code § 25402.1(h)(2) and Section 10-106 of the Building Standards Administrative Code. The Public Resources Code calls for two separate inquiries: a determination by the local government that the proposed standards are "cost effective," and the finding by the Commission that the proposed standards "will require the diminution of energy consumption levels permitted by [Title 24]." The process allows local governments to do three things: adopt the periodic updates to the state standards before the statewide effective date (advanced adoption); require additional energy conservation measures; and/or, set more stringent energy budgets.

The CPUC recommends in its Energy Efficiency Strategic Plan that local governments consider adopting enhanced building energy codes – referred to sometimes as "reach codes."[97] Many local governments in California have adopted some form of enhanced green building standards, but only 14 have adopted ordinances requiring higher energy standards than required by California's 2005 Building Energy Efficiency Standards Title 24, Part 6.[98]

[97] California Public Utilities Commission, California Long Term Energy Efficiency Strategic Plan (Sept. 2008).

[98] Local governments that have adopted more strict energy standards include: Culver City, La Quinta, Los Altos, Los Altos Hills, Marin County, Mill Valley, Palo Alto, Palm Desert, Rohnert Park, City and County of San Francisco, San Mateo County, Santa Barbara, Santa Monica, and Santa Rosa, *available at*: http://energy.ca.gov/title24/2005standards/ordinances_exceeding_2005_building_standards.html.

The CPUC also has established a long-term goal that all new homes will be net zero energy by 2020.[99] To achieve this ambitious goal the CPUC also recommends developing a pathway to achieving zero net energy, including the following targets to reach zero net energy by 2020[100]:

- By 2011, 50% of new homes will surpass 2005 Title 24 standards by 35%; 10% will surpass 2005 Title 24 standards by 55%.
- By 2015, 90% will surpass 2005 Title 24 standards by 35%.
- By 2020, all new homes are zero net energy.

In 2008, the California Building Standards Commission approved the California Green Building Standards Code.[101] The code seeks to establish a voluntary statewide green building standard that addresses health and water and energy efficiency. These standards, which will become effective August 1, 2009 provides a minimum standard that can be adopted or exceeded by local governments.[102] Although not required, the code encourages buildings to achieve a level of energy performance at least 15% better than the 2005 version of Title 24 requirements.

Overview of Enhanced New Building Energy Standard Policies

Enhanced new construction energy standards vary in scope, strictness, and design. Some focus on energy specifically while others are part of broader green building policies. Some are mandatory, while others are voluntary. Because the new construction sector has relatively low potential for GHG reductions, we present a sample of the mandatory policies in California.[103] The policies summarized here represent a range of policy approaches and city sizes.

In 2002, the County of Marin adopted mandatory energy efficiency standards for single-family homes.[104] Under the ordinance, all new single family homes, additions and substantial remodels must exceed the 2005 Title 24 Standards by 15% or greater. Projects that are 4,500 square feet or greater are required to reduce energy use to a greater degree. Residential buildings between 9,500 and 10,499 square feet are required to exceed Title 24 requirements by 51.5%. Energy targets for these buildings increases as the square footage of the building increases and vary by climate zone.

In 2008, the City and County of San Francisco enacted a mandatory Green Building Standard that requires new commercial buildings over 5,000 square feet, all new residential buildings, and renovations to areas over 25,000 square feet to meet certain levels of green building

[99] California Public Utilities Commission, California Long Term Energy Efficiency Strategic Plan, Section 1 page 6 (Sept. 2008).

[100] California Public Utilities Commission, California Long Term Energy Efficiency Strategic Plan, Section 2, p. 11 (Sept. 2008).

[101] California Green Building Standards Code, CCR, Title 24, Part 11.

[102] *Id.* at Section 101.7.

[103] For a more complete listing of energy-related and green building policies, see the California Office of the Attorney General Website *available at* http://www.ag.ca.gov/globalwarming/greenbuilding.php.

[104] Ordinance No. 3492. Ordinance of the Marin County Board of Supervisors Amending Section 19.040.100 Adopting Energy Efficiency Standards for Single Family Dwellings, Available at: http://www.co.marin.ca.us/depts/CD/main/comdev/advance/sustainability/greenbuilding/pdf/Ord3492-2008SFDEEO.pdf.

requirements.[105] In most cases building classes are required to meet an increasing Green Building standards over time, based either on the LEED or GreenPoint rating systems. The energy component of the policy requires buildings to achieve a level of efficiency 14% better than Title 24.[106] All projects that meet or exceed LEED Gold rating receive priority permit processing.[107]

The City of Santa Barbara's Local Energy Efficiency Standards requires the following building projects to meet energy efficiency standards: all new buildings, renovations above 100 square feet of conditioned area, indoor lighting alterations in conditioned space greater than 100 square feet in non-residential buildings, all new mechanical heating or cooling systems, and all projects that involve, new heaters or circulation pumps for swimming pools, spas and water features.[108] Santa Barbara requires certain mandatory efficiency requirements including that all appliances for residential construction must be Energy Star rated, all swimming pool and spa heaters and pumps must meet performance specifications, and mechanical heating and cooling systems must also meet certain National Electrical Manufacturers Association (NEMA) standards.[109] In addition, the policy requires all low-rise residential new construction or remodel projects are required to be 20% more efficient than Title 24, all new high rise residential building to be 10-15% more efficient, depending on compliance approach, and additions to high rise residential buildings to be 15% more efficient. Commercial buildings also are covered by the policy. All non-residential and hotel/motel occupancies must be 10% more efficient than required by Title 24.

The City of Palm Desert adopted required energy efficiency standards that combine prescriptive requirements and performance targets. All new homes and remodels are required to install certain lighting, mechanical, swimming pool equipment.[110] In addition, new projects are required to meet energy standards that are between 5% and 15% better than Title 24, depending on building type and size.[111]

Many jurisdictions in California have adopted voluntary new building standards that encourage energy performance better than Title 24, including the City of San Diego and City of Solana Beach. The City of San Diego's Sustainable Building Policy expedites the ministerial and discretionary permitting processes for project that meet specified energy performance standards, renewable energy generation targets, and green building certification.[112] Solana Beach has adopted a program that provides expedited permit processing and public recognition for building projects that meet the voluntary green building targets using the GreenPoint rating system (residential) and LEED (commercial).[113] Given the low numbers of homes built each

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[105] City of San Francisco Building Code Chapter 13C.

[106] City and County of San Francisco, Department of Building Inspection, Administrative Bulletin No AB-093 (Sept. 24, 2008).

[107] San Francisco Planning Department. Director's Bulletin 2006-02 (Sept. 28,2006).

[108] Santa Barbara Municipal Code Title 22, Chapter 22.82, Section 22.82.030.

[109] *Id.* at Section 22.82.050.

[110] Code of the City of Palm Desert Chapter 24.30, Section 24.30.030.

[111] *Id.* at Section 24.030.040.

[112] City of San Diego Council policy 900-14, Sustainable Building Policy (May 20, 2003).

[113] City of Solana Beach Green Building Policy *available at* http://www.ci.solana-beach.ca.us/ContentPage.asp?ContentID=322.

year relative to the total building stock and the voluntary nature of these policies, it is likely that the GHG reductions would be minimal.

Cost Considerations for Enhanced New Building Energy Standards

Cost to comply with enhanced building standards varies depending on many factors including climate, building type and size, and the requirements of the policy. Local governments seeking to adopt required building energy standards that exceed California's Title 24 requirements must demonstrate the cost effectiveness of compliance. Based on the review of local government proposals to enact local building energy standards, to calculate the cost to comply with a 15% increase over 2008 residential Title 24 standards, we assumed a cost of $1,500. For commercial building standards, we assumed a $1.00 per square foot cost to comply with a policy that requires 10% better than Title 24.

Because Title 24 and enhanced building standards based on Title 24 do not affect appliances, we also calculated to cost of requiring Energy Star appliances in new homes. Based on information from the U.S Environmental Protection Agency and the U.S. Department of Energy, the additional cost of an Energy Star appliance is $30 for refrigerators, $129 for washing machines, and for dishwashers there is no incremental cost. Based on these cost data and the potential energy savings, requiring Energy Star appliances in new homes is among the most cost effective policy measures we evaluated. Further declines in the incremental cost of Energy Star appliances would make this policy even more cost effective.

GHG Impact of Enhanced New Building Energy Standard Policies

Greenhouse impacts from enhanced new construction energy standards likely will be relatively small compared to those possible from the existing building sector. This is true for three main reasons. First, compared to the existing building stock, the percentage of new buildings constructed each year is relatively small. For example, in the residential sector, about 3 times as many homes are sold than built new each year. Second, Title 24 is one of the best building energy standard in the nation and any incremental improvement would yield relatively small energy savings. Finally, Title 24 does not regulate the total amount of energy used in a home or commercial buildings; therefore an incremental increase in Title 24 requirements may not have a significant impact on overall energy usage.

Nonetheless, local enhanced energy standards for new buildings could yield measurable GHG savings. Assuming a standard that is 15% better than 2008 Title 24 for residential buildings and 10% better for commercial buildings, a policy could reduce greenhouse gas emissions by 0.05 MMT CO_2E (0.01 MMT CO_2E from residential standards and 0.04 MMT CO_2E from commercial standards). These GHG reduction values are equal to or higher than those provided by Itron (commercial 0.04 MMT CO_2E and residential 0.003 MMT CO_2E). It should be noted that Itron's numbers are for potential for energy efficiency *programs* only and the values presented here would be more akin to the savings expected from building standards. Table 16 includes the estimated GHG reductions for both residential and commercial enhanced building standards without the retrofit mitigation option discussed below.

Table 16 GHG Reduction from Enhanced New Building Standards (Medium Scenario 2020)

Building Population	GHG Reduction (MMT CO2E)	% EPIC GHG Reduction Target
Residential	0.01	2%
Commercial	0.04	4%
Total	**0.05**	**6%**

A policy to require Energy Star appliances in all new homes would reduce GHG emissions in the region by about 0.01 MMT CO_2E, about commensurate with the emissions savings from an enhanced residential building energy standard and among the lowest of all the policies evaluated.

Policy Considerations for Enhanced New Building Energy Standards

There are many policy design and implementation options related to enhanced new building energy standards. The following discusses a range of potential policy considerations.

Mandatory vs. Voluntary Measures. Whether a policy is mandatory or voluntary is an important policy consideration. Mandatory policies capture more buildings and lead to more energy and GHG savings. A potential downside is that they are not as politically feasible as voluntary measures. As mentioned above, while voluntary measures can raise awareness about energy and other issues related to new construction, and they can lead to savings, because the new construction sector touches such a small percentage of the overall building stock, voluntary measures likely would not deliver significant energy or GHG reductions.

Performance vs. Prescriptive. Similar to efficiency retrofit policies, enhanced energy or green building standards can be performance based or prescriptive. Performance based policies can use an accepted rating standards like Build it Green or LEED to set targets and to determine compliance. Most of the jurisdictions that have enacted these policies use a performance based approach; however, there are some examples where a jurisdiction used a combined approach with a general performance based requirement coupled with mandatory prescriptive measures. Examples of cities that have prescriptive energy efficiency elements include: Palm Desert, which requires certain lighting, motor and pump efficiency; City of Rohnert Park, which requires variable speed pool pumps and Energy Star exhaust fans; Santa Barbara, which also requires variable speed pool pumps and energy star appliances and NEMA premium HVAC motors; and, City of Santa Monica, which requires efficient water heating, Energy Star appliances, light sensors and dimmers.[114]

Baseline Energy Standard. Many policies use California's Title 24 as a benchmark energy standard and require buildings to be some percentage more efficient than required under state law. Because Title 24 is periodically reviewed and regularly updated to be stricter, a local requirement to exceed Title 24 is an increasing target. Local governments can either revise their local standards periodically when Title 24 is revised or adopt a percentage knowing that it will be increasingly difficult to attain.

[114] California Department of Justice, California Attorney General Office, Local Government Green Building Ordinances in California (Dec. 18, 2008).

Pathway to Net Zero Energy. The CPUC has established aggressive long-term efficiency targets for California, including a goal for all new homes to be zero net energy by 2020. Local governments could structure an enhanced energy standard to create a pathway to this ambitious goal. For example, the City of San Francisco has implemented a standard that has increasingly strict targets over time and provides credits for solar photovoltaics.

Buildings Covered. Residential and commercial new construction projects are typically covered by most enhanced energy or green building policies. Some policies also specify which building sizes (by square footage) are covered by the policy. Many cities have also required major remodels, typically defined by floor space, to comply with the standard. The specific building types and sizes should be determined in part by general building patterns in a jurisdiction. More urban areas cities like San Francisco might have different building patterns than more diffuse development common in the San Diego region.

Enforcement. Increased standards are ineffectual if they are not property enforced. Enforcement of enhanced energy standards is usually incorporated into the standard enforcement regime the jurisdiction uses to ensure building code compliance in general. This can range from passive measures like requiring documentation or certification prior to permit approval or deed recording, or active measures such as requiring on-site inspection and/or review of plans and materials to ensure compliance and avoid extra fees or fines. Recognizing the importance of enforcement, the County of Marin's Single Family Dwelling Energy Efficiency Ordinance includes specific language regarding enforcement.[115] A more detailed discussion of T24 enforcement is included in Section 3.3.2.

Mitigation via Existing Building Offsets. One option to increase flexibility of such a policy would be to develop an offset mechanism to allow new home builders to meet energy or green building standards by paying into a mitigation bank that would provide funding for projects to reduce energy use or greenhouse gas emissions in existing buildings. It is not clear that builders would be willing either to conduct retrofits directly or pay into a mitigation bank; builders might prefer to use money to enhance their products. In addition, such a program would have some level of administrative cost and complexity, particularly allocating funds for existing building projects. Another challenge for such a mitigation plan would be measurement and verification of energy or GHG savings.

The offset concept has been used to mitigate for the effects of new development on water. The City of Lompoc requires new buildings to offset through retrofits in existing buildings an amount of water expected to be consumed by the new construction project.[116] Project developers can execute the water retrofits themselves or pay an "in-lieu" fee to the City to help fund the City's water retrofit/rebate program.

Incentives. Jurisdictions that have adopted mandatory energy or green building standards often provide incentives for meeting or exceeding the standard. Incentives mechanisms include expedited permit processing and inspections, fee waivers, recognition, and floor-to-area and

[115] Ordinance No. 3492. Ordinance of the Marin County Board of Supervisors Amending Section 19.040.100 Adopting Energy Efficiency Standards for Single Family Dwellings, *available at* http://www.co.marin.ca.us/depts/CD/main/comdev/advance/sustainability/greenbuilding/pdf/Ord3492-2008SFDEEO.pdf.

[116] City of Lompoc. 2005 Urban Water Management Plan, *available at* http://www.cityoflompoc.com/utilities/pdf/2005_uwmp_final.pdf.

unit density bonuses.[117] An alternative to these incentive structures is a "feebate," which could impose a fee on projects that meet minimum requirements of Title 24 and provide financial rebates to projects that exceed Title 24. The City of Portland, has proposed a Green Building Feebate that would charge higher permit fees for new buildings meeting only the minimum requirements of Oregon's energy code and would waive the fee or provide a cash reward for new buildings that exceed minimum requirements.[118]

Advantage and Disadvantages of Enhanced New Building Energy Standards

The main advantage of enhanced new building energy standards is that the resulting energy savings and GHG emissions reductions are built in to the structure and persist over time. Also, there are several existing new construction rating systems, including LEED and Build it Green, which could reduce administrative start up costs. Further, many local governments in California have adopted either enhanced energy or green building standards. These examples could reduce costs related to policy development. In the case of commercial standards, the cost of implementation is relatively low.

On the other hand, new construction standards only capture about small percentage of the total building stock, therefore GHG emissions reductions would be low (residential) to medium (commercial). The cost of implementation is high for residential buildings. Other disadvantages include the need to enforce enhanced standards and potential opposition from the building and development communities.

3.3.2. Title 24 Enforcement

As mentioned above, California Title 24 building energy efficiency codes are among the best in the U.S.; however, standards are only effective if they are enforced. And, while the California Standards Commission promulgates building standards, local governments enforce them. The Air Resources Board recognized the importance of code compliance in its Scoping Plan, stating that "lack of compliance and enforcement of building and appliance energy standards has been identified as a significant barrier, especially in the application of standards to remodels and retrofits."[119] The CPUC also acknowledged this issue in its Energy Efficiency Strategic Plan.

A 2004 Itron Inc. study that sampled new homes found that 47% complied with state building standards, 27% of homes were non-compliant, and in 26% of cases it was not possible to determine compliance because their compliance margin was within the error range of the study.[120] The study examined compliance rates based on climate zones. Three climate zones included in the study are located in San Diego County – climate zone 2 (coastal), climate zone 3

[117] California Department of Justice, California Attorney General Office, Local Government Green Building Ordinances in California (Dec. 18, 2008).

[118] City of Portland Bureau of Planning and Sustainability Website, *available at* http://www.sustainableportland.org/bps/index.cfm?c=45879 (last visited June 22, 2009).

[119] California Air Resources Board, Scoping Plan Appendix p. C-107.

[120] Itron Inc., Analysis of Title 24 Compliance for Single Family Homes p. 4-4. Non-Compliance is defined as having a compliance margin less than the lower end of the error band (i.e., <-5%), indeterminate is a compliance margin within the error band (-5% to 4%), compliant includes sites that have a % compliance margin greater than the upper end of the error band (i.e., > 4% and < 19%).

(inland), climate zone 5 (mountains and desert).[121] Of the homes sampled, ninety-three percent (93%) of homes in the coastal zone complied with energy codes, 83% of homes in the coastal inland region complied, and 18% of homes in the mountain and desert regions complied. Given the relatively small sample size from San Diego County, it is difficult to draw specific conclusions from the study, but it appears that in general Title 24 code enforcement is worse in mountain and desert communities, where populations are smaller but energy consumption is typically higher per capita primarily due to cooling needs.

CARB recommends that the state assist local governments with enforcement activities, including additional training for local building department inspectors and plan checkers, contractors and builders, and energy related trades (e.g., plumbers, electricians, controls technicians and engineers). It also proposes that the state support enforcement activities "by developing and providing to localities information on best practices for energy efficiency code enforcement. Furthermore, the CEC is in the process of streamlining compliance verification tools and mechanisms; additional work may be needed in this area if resources are available."[122]

In its Single Family Dwelling Energy Efficiency Ordinance, the County of Marin acknowledges the importance of code enforcement, Section 4 of the policy states:

> Given that the purpose of this ordinance is to adopt stricter local energy efficiency standards for the construction of residential buildings within Marin County, the Board of Supervisors recognizes that the adoption of new standards without additional education and training for County staff responsible for enforcement of the standards can diminish compliance and potentially undermine the efficacy of this ordinance. Therefore, in order to ensure greater compliance and enforcement of the applicable energy efficiency standards, to better equip building department staff, and to provide a greater resource to the County's building community, the County will seek out additional education and training opportunities for building department staff in the areas of energy standards, building energy technology and energy code implementation. [123]

Given the relatively limited number of homes affected by enhanced Title 24 compliance and the relatively low potential to reduce GHG emissions, this report does not provide any analysis of cost, time to implement, and GHG impacts. We include it here as a reference.

3.3.3. Solar Water Heating

As noted above, California's Long-Term Energy Efficiency Strategic Plan seeks to make all new homes in 2020 net zero energy homes. Often this is interpreted to mean net zero *electricity* homes. To be – or to approach – truly net zero *energy*, a combination of efficiency, on-site generation (e.g., photovoltaics), and solar water heating likely would be needed. As part of the decision approving the California Solar Initiative, the CPUC approved a pilot solar water

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[121] Id at 3-2 and 3-3. Note that the study uses the RMST climate zone classifications. For San Diego County climate zones, California Energy Commission Climate Zone (CZ) 7 is contained in RMST CZ2, CEC CZ 10 is contained in RMST CZ 3, and CEC CZ 14 and 15 are contained in RMST CZ 5.

[122] California Air Resources Board. Scoping Plan Appendix p. C-107.

[123] Ordinance No. 3492. Ordinance of the Marin County Board of Supervisors Amending Section 19.040.100 Adopting Energy Efficiency Standards for Single Family Dwellings, *available at* http://www.co.marin.ca.us/depts/CD/main/comdev/advance/sustainability/greenbuilding/pdf/Ord3492-2008SFDEEO.pdf.

heating incentive program for the San Diego Gas & Electric territory.[124] The Solar Water Heating Pilot Program (SWHPP), implemented by the California Center for Sustainable Energy, provides financing incentives to offset a portion of the cost of installing an eligible solar water heater. The CPUC is considering making this a statewide program, which would make incentives available beyond the pilot period.

Local governments can adopt policies to help to encourage use of solar water heating and to leverage the financial incentives that will be available under the CPUC solar water heating program. This section provides a brief summary of several related policies.

Pre-plumb for solar water heating

Two jurisdictions in the San Diego region currently require that all new homes be pre-plumbed to accommodate future installation of solar water heating. The City of Carlsbad, which adopted such a requirement in 1981, requires all new residential units to include "plumbing specifically designed to allow the later installation of a system which utilizes solar energy as the primary means of heating domestic potable water."[125] A builder can be exempt from this requirement if he can demonstrate that including the pre-plumbing is not practical due to shading, building orientation, construction constraints, or configuration of the parcel. The City of Chula Vista recently adopted a similar ordinance.[126]

A pre-plumb policy would result in relatively low GHG emissions reductions. Assuming that 1% of all homes are built new each year, 15% of the pre-plumbed homes actually installed solar water heating, and that annual natural gas savings is 117 therms, total GHG savings would be 0.01 MMT CO_2E. Emissions reductions would be higher if a higher percentage of homebuyers install systems.

The costs associated with a pre-plumb policy include those associated with additional construction requirements and the eventual cost of installing a solar water heater. Piping and other equipment related to compliance likely would be small relative to the overall cost of a typical home. When considering adoption of its current pre-plumb policy, the City of Chula Vista estimated that it would cost $450 per residential unit to comply.[127] The cost of installing a solar water heater would be significantly higher. The average cost of a system installed through the CSI Solar Water Heating Pilot Program (SWHPP) in the San Diego region has been $6,500.[128] The CPUC is evaluating whether to extend the SWHPP statewide and to increase its funding significantly. This would continue the financial incentives available in the San Diego region to reduce the first cost of such systems.

The main advantages to pre-plumb requirements are the relatively low cost to comply and reducing the complexity and possibly cost of future installations. A significant drawback to a

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[124] California Public Utilities Commission (CPUC) Decision D.06-01-024 (Jan. 12, 2006).

[125] Carlsbad Municipal Code Section 18.30.020. (Ord. NS-676 § 7 (part), 2003; Ord. 1261 § 26, 1983; Ord. 8094 § 1, 1981; Ord. 8093 § 1 (part), 1981).

[126] City of Chula Vista Municipal Code -- Section 15.28.015 Ord. 3122 § 1, 2009.

[127] Personal Communication with Brendan Reed, City of Chula Vista. Email 7-21-09 2:02:40 PM PDT.

[128] California Public Utilities Commission, CSI-Thermal Program: Energy Division Staff Proposal for Solar Water Heating Program. R.08-03-008 Administrative Law Judge's Ruling Noticing Workshop and Requesting Comment on Staff Proposal for Solar Water Heating Program (July 15, 2009), *available at* http://docs.cpuc.ca.gov/efile/RULINGS/104402.pdf and http://docs.cpuc.ca.gov/efile/RULINGS/104403.pdf.

solar pre-plumb policy is that there is no evidence that the existing policies have led to installation of solar water heaters. It is possible that a statewide incentive program could raise awareness of this technology and help to educate new homebuyers about its attributes. It is also possible that new homebuilders would oppose such policies.

Requiring Solar Water Heaters

In July 1999 Barcelona, Spain adopted a policy requiring that solar hot water systems supply a portion of the overall hot water supply of certain buildings.[129] Barcelona's Solar Thermal Ordinance applies to new construction, major rehabilitations, buildings seeking a change of use that have an annual average forecasted hot water need greater than 276,000 net British Thermal Units (BTU) or 2.8 therms.[130] This regulation applies to the following types of buildings: residential, health-care, sports, commercial and industrial use and, generally, any activity involving the existence of dining rooms, kitchens, laundries or other circumstances that lead to high hot water consumption.[131]

Between 2000, when the ordinance went into effect, and 2006, Barcelona had 597 solar water heating projects, equivalent to over 333,000 square feet of solar water heater collectors, a significant increase over the previous total area of collectors, which was just over 17,000 square feet.[132] The City of Barcelona estimates that the amount of solar hot water collector area installed as a result of this ordinance has led to thermal energy reductions equivalent to 32,076 MWh/year and a reduction of 5,604 metric tons of carbon dioxide emissions.

3.3.4. Energy Rating and Disclosure for New Construction

Similar to the energy rating and disclosure requirement for existing residential buildings discussed in Section 3.2.4, local governments could require new homes to disclose energy performance. There are few examples of such policies. Kansas adopted its Thermal Energy Disclosure Law in 2003.[133] It requires homebuilders and realtors to disclose information about the energy efficiency of new homes to potential homebuyers prior to purchase, whenever the house is shown and at any other time upon request. The law requires completion of a disclosure form on which the seller must indicate whether the building has a Home Energy Rating of 80 or more, was built to meet a specified energy code, or has other energy efficient elements listed.

South Dakota adopted a similar law in March 2009.[134] The law requires sellers of previously unoccupied new residential buildings (single-family or multifamily properties of four units or

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[129] For a copy of the ordinance, see the Barcelona Energy Agency Website, *available at* http://www.barcelonaenergia.cat/document/OST_Explicac_eng.pdf (last visited June 20, 2009); *See also* http://www.barcelonaenergia.cat/eng/operations/ost.htm.

[130] City of Barcelona, Spain. Ordinance on the Incorporation of Solar Therms Energy Collection in Buildings. Article 2 (c).

[131] *Id.* at Article 3 Section 1.

[132] Barcelona Energy Agency Website, *available at* http://www.barcelonaenergia.cat/eng/operations/ost.htm.

[133] KSA66-1228. Kansas Statutes Chapter 66, Article 12, Stature 66-1128.

[134] SB 64, *available at* http://legis.state.sd.us/Sessions/2009/SessionLaws/DisplayChapter.aspx?Chapter=63. No statutory reference as of June 2009.

less) to disclose to the buyer or prospective buyer information regarding the energy efficiency of the residential building.

It is not possible to estimate the greenhouse gas emissions reductions from an energy and rating disclosure policy; we include it here as a reference.

3.3.5. Overview of Findings for New Construction Policies

In general, policies that address new buildings do not reduce GHG emissions as much as those focused on existing buildings. This is true partly because the number of buildings constructed each year represents a small fraction of the entire building stock. Also, California new construction building standards require significant levels of efficiency and requirements to reach efficiency levels above those required by Title 24 do not yield much savings. Further, Title 24 only regulates a small portion of a buildings overall energy consumption.

Of the policies evaluated here, enhanced commercial building standards have the highest potential to reduce GHG emissions regionally (Figure 8). It is also the only new construction policy to have a low cost per metric ton of GHG emissions. Requiring Energy Star appliances does not have a large potential to reduce emissions, but it is among the most cost effective policies evaluated (Table 17).

Figure 8 Greenhouse Gas Reductions from New Construction Policies (Medium Scenario 2020)

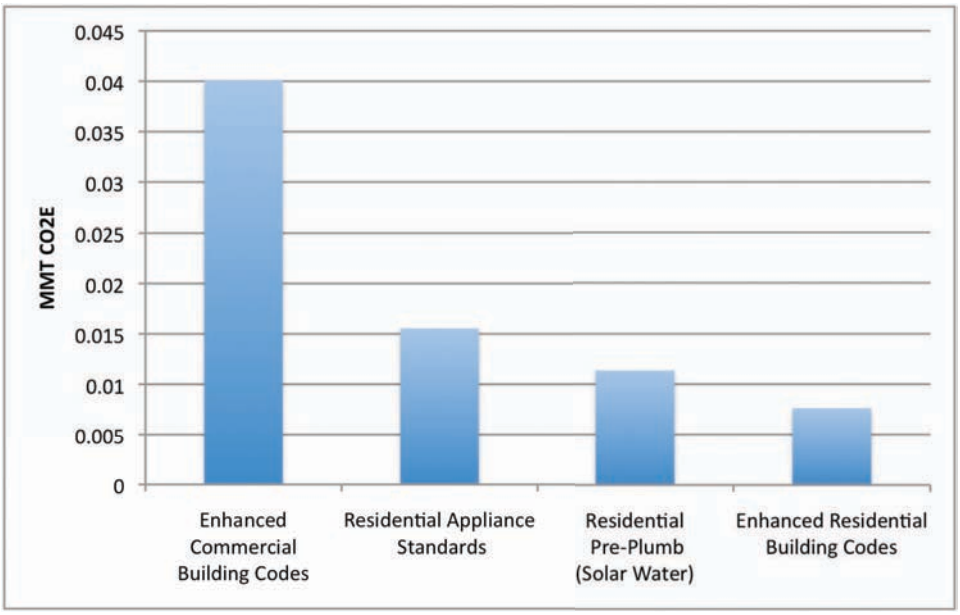


Table 17 Summary of Greenhouse Gas Reduction Potential and Cost for New Construction Policies (Medium Scenario 2020)

GHG Reduction Policy Measure	GHG Reduction Potential	Cost per Ton of GHG Reduction
Enhanced Commercial Building Codes	Medium	Low
Residential Appliance Standards	Low	Low
Residential Pre-Plumb (Solar Water)	Low	High
Enhanced Residential Building Codes	Low	High

4. PHOTOVOLTAICS

Electricity consumption accounts for 26% of overall region GHG emissions. In addition to energy efficiency, reducing the GHG intensity of electricity is another strategy to reduce emissions. California's Renewable Portfolio Standard seeks to increase the amount of renewable energy that electric utilities supply to customers. Another way to increase the renewable content of the overall electricity supply is to encourage distributed photovoltaics.

In the San Diego County Greenhouse Gas Inventory, we estimated the emissions reduction potential from a total of 400 MW of photovoltaics in San Diego County by 2020 to be 0.2 MMT CO_2E, which represents about 1% of the overall GHG emissions reductions needed to reach 1990 levels by 2020.[135] According to a recent report, there are 19 MW of distributed photovoltaics installed within the City of San Diego. This is more than in any other city in California and because California's dominates the U.S. solar market, the City of San Diego likely has more solar than any other City in the U.S.[136]

Distributed photovoltaics, defined as systems installed at or near the point of use, are a desirable generation option in some cases given their modularity, relative speed of installation, and partial coincidence with peak electric loads. As mentioned above, California seeks to achieve net zero energy in new residential buildings by 2020 and commercial buildings by 2030. Photovoltaics will play a critical role in achieving these targets.

Table 18 includes a list of the policies discussed in this section and examples of jurisdictions that have adopted similar policies.

Table 18 Policies to Encourage Photovoltaics

POLICY OR MEASURE	JURISDICTIONS THAT HAVE ADOPTED THE POLICY OR MEASURE
Regional or Citywide Rooftop Photovoltaics Target	San Diego (CA) San Francisco (CA), Sonoma (CA)
Pre-wire for Photovoltaics	Chula Vista (CA), Palm Desert (CA)
Require Photovoltaics on New Buildings - Commercial	Culver City (CA)
Require Photovoltaics on New Buildings - Residential	N/A

4.1. Background

In 2005, the CPUC began developing a long-term program to provide financial incentives to photovoltaics systems.[137] In 2006, Governor Schwarzenegger signed into law SB 1, which

[135] This emissions reduction number is revised down from 0.21 in the September 2008 San Diego Regional Greenhouse Gas Inventory due to a refined methodology of calculating emissions and an updated electricity forecast by the California Energy Commission.

[136] Environment California, California's Solar Cities: Leading the Way to a Clean Energy Future (July 2009).

[137] *See* R.06-03-040, in particular D.05-12-044 and D.06-12-033.

codified this effort and set forth spending limits and basic program requirements.[138] SB 1 allocated $3.3 billion in ratepayer funds with a goal to install 3,000 MW of distributed photovoltaics by 2016. Of this total, $2.17 is allocated to the CPUC's California Solar Initiative, which has a goal to provide incentives for 1,940 MW of photovoltaics system. The CEC administers the New Solar Homes Partnership, which seeks to install 360 MW of photovoltaics in new homes and has a budget of $400 million. SB 1 allocated $784 million to municipal utilities, which have a target of installing 700 MW. Table 19 provides a summary of the program funding and capacity targets for the elements of SB 1.

Table 19 Funding Levels and Capacity Targets Included in SB1

	CA Public Utilities Commission	CA Energy Commission	Municipal Utilities	Total
Program	CA Solar Initiative	New Solar Homes Partnership		
Budget ($million)	$2,167	$400	$784	$3,351
Capacity Target (MW)	1,940	360	700	3,000
San Diego MW	220	31	0	251

In the San Diego region, the CSI program is administered by the California Center for Sustainable Energy. By 2016, the program expects to provide incentives for 180 MW, including 60 MW in the residential sector and 120 MW in the non-residential sectors. As of June 3, 2009, 19 MW of photovoltaics had been installed through the CSI program in the SDG&E service territory, which serves all of San Diego County and a portion of Orange County.[139]

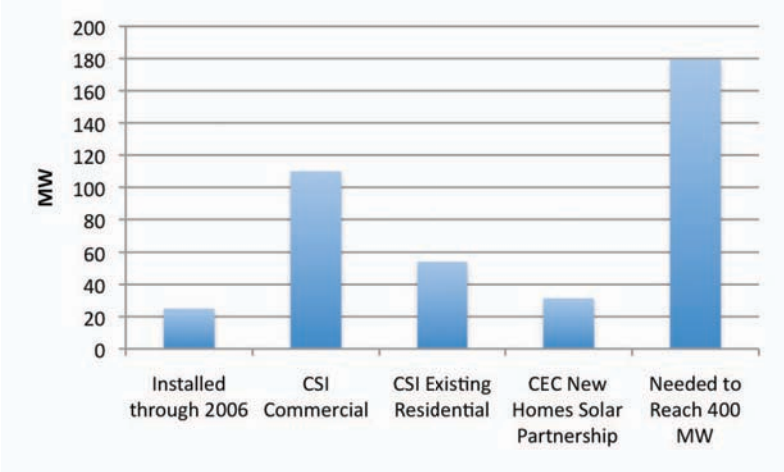
While the CEC New Solar Homes Partnership Program (NSHP) is a statewide program and does not allocated funding or capacity targets to utility service territories or other jurisdictions, the prorated portion of the statewide target of 400 MW based on peak demand would be 31 MW.

If all the expected capacity through all of California's photovoltaics incentive programs were realized, it would equal about 220 MW in the San Diego region. An additional 180 MW would be need be needed between 2017-2020 to reach the 400 MW target included in the EPIC inventory report (Figure 9). It is unclear whether this is possible and achieving such a significant amount of installations in a short period would depend to a large extent on the installed cost of photovoltaics in 2016. One aim of the CSI program is to reduce the installation costs of photovoltaics. The level of subsidies available could provide a limit on the solar photovoltaics market. Both the CSI and federal tax credits will expire in 2016. Whether installed prices without subsidies in 2017 are equal to the previous cost with subsidies will be a significant determining factor in whether the photovoltaics market can continue to expand in the San Diego region.

[138] Senate Bill 1 (Murray). SB1 also to requires new homebuilders to offer photovoltaics as a standard option by 2011.

[139] California Solar Initiative Solar Statistics Website, *available at* http://www.californiasolarstatistics.ca.gov/reports/6-03-2009/Dashboard.html.

Figure 9 Expected Photovoltaics Capacity from Incentive Programs (San Diego County)



Even though it is difficult to determine how many additional MW of photovoltaics would be realized by the policies discussed here between now and 2016, we include the potential GHG emissions reductions potential from policies to encourage photovoltaics in one of the two main scenarios presented below in Section 5.

4.2. Policy Options to Promote Installation of Rooftop Photovoltaics

Similar to energy efficiency policies, local governments have jurisdiction over several areas that affect photovoltaics, including permitting, zoning, general planning, and codes and standards. This section provides a range of policy options that local governments can adopt to promote the use of photovoltaics in the San Diego region.

4.2.1. Establish a Regional or Citywide Rooftop Photovoltaics Target

Several California jurisdictions have established specific photovoltaics installation targets as part of their climate action or sustainability planning. For example, the City of San Francisco has established a target of installing 10,000 photovoltaics systems by 2010.[140] The City of Sonoma has set a goal of installing 25 MW by 2011.[141] In 2003, the City of San Diego City Council adopted Resolution R-298412 that established a goal to install 50 MW of renewable energy within the city limits by 2013, though no specific photovoltaics target is included.[142]

4.2.2. Review Zoning Ordinances to Identify Barriers to PV

California law encourages local governments to remove barriers to solar energy installation. California Government Code Section 65850.5 states the following:

[140] San Francisco Solar Map, *available at* http://sf.solarmap.org/.

[141] U.S. Department of Energy Solar America Cities Website, *available at* http://www.solaramericacities.energy.gov/Cities.aspx?City=Santa%20Rosa.

[142] City of San Diego RESOLUTION NUMBER R-298412 (Sept. 23, 2003), *available at* http://docs.sandiego.gov/council_reso_ordinance/rao2004/R-298412.pdf.

> It is the intent of the Legislature that local agencies not adopt ordinances that create unreasonable barriers to the installation of solar energy systems, including, but not limited to, design review for aesthetic purposes, and not unreasonably restrict the ability of homeowners and agricultural and business concerns to install solar energy systems. It is the policy of the state to promote and encourage the use of solar energy systems and to limit obstacles to their use. It is the intent of the Legislature that local agencies comply not only with the language of this section, but also the legislative intent to encourage the installation of solar energy systems by removing obstacles to, and minimizing costs of, permitting for such systems.[143]

Certain city policies and zoning requirements may create unintended barriers to installing photovoltaics. While California statute does not require local government to identify and remove barriers, Marin County has reviewed sections of its municipal code to identify potential unintended barriers to energy efficiency, including the zoning component of its municipal code, and identified a number of current requirements that may hinder energy efficiency and renewable energy.[144] Examples of code sections that might unintentionally disadvantage solar installations include set back requirements, which can contain maximum height limits that might preclude certain solar equipment from being placed in the setback, height regulations, which typically include exemptions for other equipment, and use permit requirements, which might affect free-standing, ground-mounted systems.

4.2.3. Pre-wire New Building for Photovoltaics

Several cities in California have adopted ordinances that require certain new buildings to include the wiring necessary to install photovoltaics at a later date. The City of Chula Vista has enacted a photovoltaics pre-wiring ordinance that requires that "all new residential units shall include electrical conduit specifically designed to allow the later installation of a photovoltaic (PV) system which utilizes solar energy as a means to provide electricity." [145] The City of Chula Vista's requirement can be waived if the building owner can demonstrate that compliance would be impractical due to shading, building orientation, construction constraints or configuration of the parcel. The City of Palm Desert has adopted a similar requirement that provides detailed requirements for the location and specifications of the equipment needed to comply.[146]

The costs to develop and implement and to comply with photovoltaics pre-wire requirements likely would be relatively low. Existing ordinances provide models for policy development and given the straightforward nature of the concept, policy considerations are few. The cost of conduit, wiring, and other equipment related to compliance likely would be small relative to the overall cost of a typical home. When considering adoption of its current policy, the City of Chula Vista estimated that compliance would cost $350 per residential unit.[147] If in the future a photovoltaics system is installed on a pre-wired home, the homeowner would incur the cost of installation. The average statewide installed cost of a residential photovoltaics system installed

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[143] Cal. Gov. Code 65850.5(a).

[144] Unintended Barriers to Energy Efficiency in the Development Code, *available at* http://www.co.marin.ca.us/depts/CD/main/fm/cwpdocs/Energy_Dev_Code.pdf.

[145] City of Chula Vista Municipal Code - 15.24.065. (Ord. 3121 § 1, 2009).

[146] City of Palm Desert Ordinance No. 1124, Section 24.30.030.

[147] Personal Communication with Brendan Reed, City of Chula Vista. Email 7-21-09 2:02:40 PM PDT.

through the CSI program in 2008 was $9.41/watt AC.[148] Installation costs have declined over time, so we assumed a 3% annual reduction when estimating the cost of a pre-wire policy. For purposes of comparing the cost of GHG mitigation measures included in this report, we use the total installed cost and did not take into account current financial incentives, which can reduce the cost to customers.

Greenhouse gas emissions reductions from a photovoltaics pre-wire policy could be significant, depending on the rate at which homeowners install systems on pre-wired homes and the average size of systems installed. Similar to the rating and disclosure policy described in Section 3.2.4 and the solar pre-plumb policy in Section 4.4.3, there is no certainty and indeed no evidence that residents would install photovoltaics systems in the future. If significant numbers of residents installed photovoltaics systems after purchasing a new home or existing home that had been pre-wired for photovoltaics, the GHG savings could be notable.

For example, if 15% of the pre-wired homes built each year installed a 2 kW photovoltaics system, the total installed capacity of photovoltaics would be 40 MW by 2020, which would reduce GHG by 0.02 MMT CO_2E. Because the cost effectiveness of installing photovoltaics on homes is heavily dependent on subsidies like the California Solar Initiative and available federal tax credits, it is not clear whether a pre-wire policy would lead to any solar installations above and beyond what we might expect as a result of existing financial programs – at least through 2016.

Advantages and Disadvantages of a Solar Pre-Wire Policy

Solar pre-wire policies have two main advantages. The cost to comply is relatively low and making homes "solar PV ready" may decrease the complexity and costs of future installations. Unfortunately, there is no evidence that owners of pre-wired homes would install solar electric generation systems after purchase; therefore, based in our estimates, potential GHG reductions are comparably low and the cost of implementation (including the eventual PV installation) is relatively high. It is also possible that new homebuilders would oppose such policies.

4.2.4. Require Solar Photovoltaics on New Buildings

The City of Culver City requires new buildings that are 10,000 square feet or greater, additions and major renovations of 10,000 square feet or greater of gross floor area to install 1 kW of photovoltaics for each 10,000 square feet of gross floor area.[149] In the case of major renovations, to be required to comply with the photovoltaics requirement, the renovation must be equal to 50% of the valuation of the existing building. The requirement does not apply to one- and two-family residences, parking structures, and garages. Also, the policy provides for two alternative compliance mechanisms, including a fee-in-lieu options whereby the building owner can pay a fee equal to the cost of installing the system. Revenue generated from the fee would be used to design and install photovoltaics system on city facilities. To comply with the solar requirement, building owners also can install comparable photovoltaics on another building owned by the applicant and located in the city.

[148] California Public Utilities Commission. California Solar Initiative Annual Program Assessment, p. 22 (June 2009). *Available at,* http://docs.cpuc.ca.gov/PUBLISHED/GRAPHICS/103173.PDF.

[149] Ord. No. 2008-004 § 1 (part) § 15.02.1005.

As mentioned above in Section 3.3.1, the County of Marin adopted mandatory energy efficiency standards for single-family homes.[150] This ordinance does not explicitly require photovoltaics but does require very aggressive energy reduction requirements for large homes that likely could require photovoltaics for compliance. The Marin County ordinance does provide for a solar credit to meet the targets.

If all jurisdictions in San Diego County adopted a policy similar to the City of Culver City requirement for commercial buildings and installed 5 kW for every 10,000 square feet of new building space, an estimated 50 MW would be installed by 2020 with relatively low greenhouse gas emission reductions (0.02 MMT CO_2E). Increasing the amount of photovoltaics required per 10,000 square feet would increase the total GHG emission reduction. Similarly, if all new homes were required to install 2 kW of photovoltaics the resulting capacity would be nearly 200 MW and a GHG reduction of 0.1 MMT CO_2E. This number is substantially higher than the commercial results due to per unit amount of photovoltaics assumed in our calculations.

A 2009 CPUC report on the California Solar Initiative reported average statewide installed costs or projects receiving incentives in 2008 to be $9.41 for residential and small commercial systems and $8.14 for large commercial systems. For purposes of estimating the cost per unit of GHG emissions for photovoltaics-related policies, we assumed a steady decline in installed prices. Also, for purposes of estimating life-cycle cost, we assumed a useful life of 20 years.

4.2.5. Summary of Finding for Photovoltaics Related Policies

Of the policies evaluated, requiring photovoltaics on new homes would yield the highest GHG reductions, followed requiring photovoltaics on commercial building, and pre-wiring residential buildings for solar (Figure 10). Each of the policies evaluated has a medium cost of GHG reduction (Table 20).

It is not clear how to account for and allocate GHG reductions associated with photovoltaics. The current market is reliant on financial subsidies in the form of state rebates and federal tax incentives, both of which are set to expire in 2016. Between now and 2016, it is possible that the amount of installed photovoltaics will not increase to a level much higher than that which can be sustained with existing incentive programs.

[150] Ordinance No. 3492. Ordinance of the Marin County Board of Supervisors Amending Section 19.040.100 Adopting Energy Efficiency Standards for Single Family Dwellings, *available at* http://www.co.marin.ca.us/depts/CD/main/comdev/advance/sustainability/greenbuilding/pdf/Ord3492-2008SFDEEO.pdf.

Figure 10 GHG Reductions from Photovoltaics Related Policies (Medium Scenario, 2020)

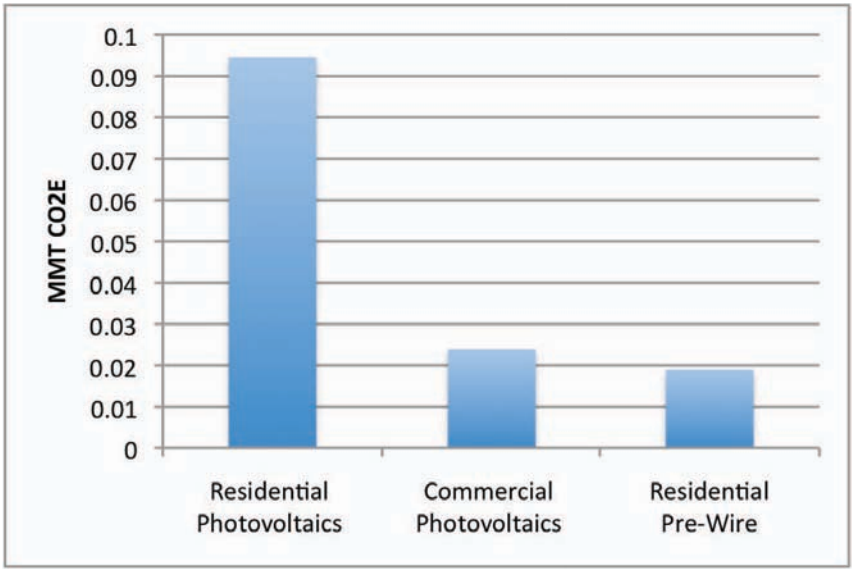


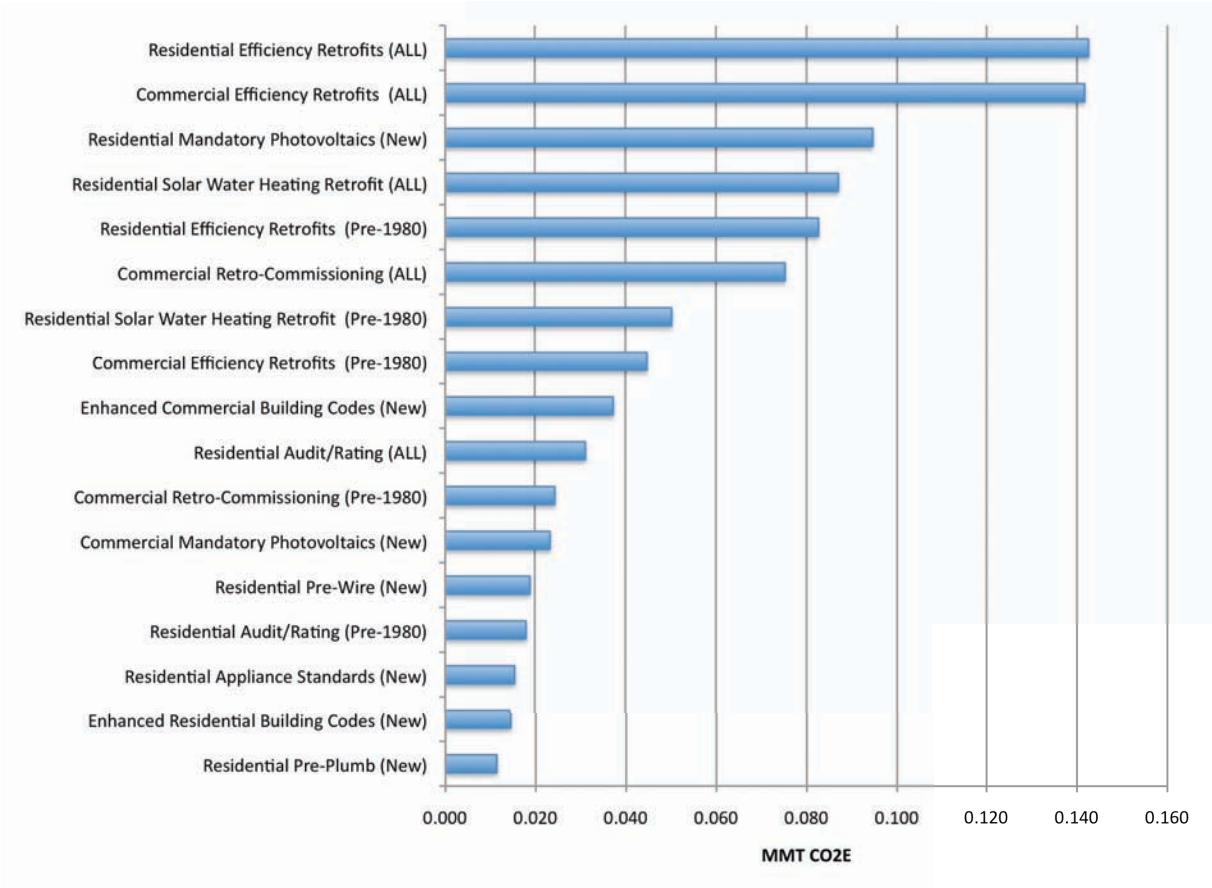
Table 20 Summary of GHG Reduction Potential and Cost

GHG Reduction Policy Measure	GHG Reduction Potential	Cost per Ton of GHG Reduction
Residential Photovoltaics	High	Medium
Commercial Photovoltaics	Low	Medium
Residential Pre-Wire	Low	High

5. OVERALL FINDINGS

This section provides a summary of the overall findings of the study. When all local policy measures assessed in this report are combined, it is possible to compare the relative GHG reduction potential and implementation cost and to assess their combined impact. Of the policies included in this report, residential and commercial efficiency retrofits targeting a percentage of all buildings have by far the highest GHG reduction potential, followed by a requirement to install solar photovoltaics on new homes (Figure 11) and a policy to install solar water heating systems on existing homes. Also, the vast majority of potential GHG reductions from the policies evaluated – between 55% and 73%, depending on the building population addressed, result from policies that target existing buildings.

Figure 11 Summary of GHG Emission Reduction Potential (Medium Scenario, 2020)



There are 5 policies that have high potential to reduce GHG emissions in the region. None of these have high implementation costs and only one policy – requiring commercial energy retrofits in a percentage of all buildings – also has a relatively low cost of implementation. Three policies – (1) requiring commercial retro-commissioning in a percentage of all buildings, (2) commercial efficiency retrofits in buildings built prior to the adoption of energy codes, and (3) a local policy to require new commercial buildings to be more energy efficient than mandated by state law – also have a low cost of implementation but they all have a medium potential to reduce emissions. Table 24 provides a summary of the GHG reduction potential and the associated cost for the policies evaluated in this study. The information presented in

Table 21 is sorted in order of GHG potential from high to low. Figure 12 provides the same results in a different format to show the relationship between GHG reduction potential and cost.

Table 21 Summary Table of GHG Reduction Potential and Cost (Medium Scenario 2020)

GHG Reduction Policy Option	GHG Reduction Potential[1] (MMT CO2E)	Cost per Unit of GHG Reduction[1] ($/MT CO2E)
Residential Efficiency Retrofits (ALL)[2]	H	M
Commercial Efficiency Retrofits (ALL)	H	L
Residential Photovoltaics (New)[3]	H	M
Residential Solar Water Heating Retrofit (ALL)	H	M
Residential Efficiency Retrofits (Pre-1980)	H	M
Commercial Retro-Commissioning (ALL)	M	L
Residential Solar Water Heating Retrofit (Pre-1980)	M	M
Commercial Efficiency Retrofits (Pre-1980)	M	L
Enhanced Commercial Building Codes (New)	M	L
Residential Audit/Rating (ALL)	M	H
Commercial Retro-Commissioning (Pre-1980)	L	L
Commercial Photovoltaics (New)	L	M
Residential Pre-Wire (New)	L	H
Residential Audit/Rating (Pre-1980)	L	H
Residential Appliance Standards (New)	L	L
Enhanced Residential Building Codes (New)	L	H
Residential Pre-Plumb (New)	L	H

[1] L=Low M=Medium H=High

[2] "All" means policy targets a percentage of all buildings.

[3] "Pre-1980" means policy targets a percentage of buildings built before 1980.

Figure 12 GHG Reduction Potential and Cost Matrix (Medium Scenario 2020)

GHG Reduction \ Cost to Reduce GHG	Low	Medium	High
Low	Commmercial Retro-Commissioning (Pre-1980) Residential Appliance Standards	Commercial Photovoltaics (New Construction)	Residential Pre-Wire (Photovolitaics) Residential Rating/Disclosure (Pre-1980) Enhanced Residential Building Codes Residential Pre-Plumb (Solar Water)
Medium	Commercial Retro-Commissioning (All) Commercial Efficiency Retrofits (Pre-1980) Enhanced Commercial Building Codes	Residential Solar Water Heating Retrofit (Pre-1980)	Residential Rating/Disclusure (All)
High	Commercial Efficiency Retrofits (All)	Residential Efficiency Retrofits (All and Pre-1980) Residential Photovoltaics (New Construction) Residential Solar Water Heating Retrofit (All)	N/A

For the San Diego region to reach AB 32 targets, EPIC estimated that it would be necessary to reduce GHG emissions from electric and natural gas consumption by 0.9 MMT CO_2E and 0.2 MMT CO_2E from increased use of solar photovoltaics (PV). To determine the combined effect of the policies assessed here, we created four scenarios that vary based on the target population of existing buildings and whether emission reductions from PV are included. As mentioned above, it is unclear how much *net* GHG reductions between now and 2016 could be realized by local policies that target photovoltaics. These four scenarios are:

- **Scenario 1: Efficiency Only (All Buildings)** – existing building policies target a percentage of the entire building stock annually and GHG reductions from solar photovoltaics is not included.
- **Scenario 2: Efficiency Only (Pre-1980 Buildings)** – existing building policies target a percentage of the pre-1980 buildings annually and GHG reductions from solar photovoltaics is not included.
- **Scenario 3: Efficiency (All Buildings) + PV** - existing building policies target a percentage of the entire building stock annually and GHG reductions from solar photovoltaics are included. Because PV is included the target for scenarios 3 and 4 is 1.1 MMT CO_2E.
- **Scenario 4: Efficiency (Pre-1980 Buildings) + PV** - existing building policies target a percentage of the pre-1980 buildings annually and GHG reductions from solar photovoltaics are included.

For each of these four scenarios we show a range of emissions reductions (low, medium, and high) based on the adoption rate or assumed level of savings.[151] If adopted region wide, no scenario of local efficiency policies (Scenarios 1 and 2) could achieve the 0.9 MMT CO_2E target alone. Similarly, no scenario of policies that combines efficiency and solar photovoltaics (Scenarios 3 and 4) can meet the combined target of 1.1 MMT CO_2E. However, in both cases, combining estimated emission reductions from local policies with those projected from statewide policies and programs, it could be possible to achieve the target by 2020.

Figure 13 shows a range of GHG emission reductions from 4 scenarios, including a low, medium, and high estimate for each scenario. Table 8 below includes the values used to calculate scenario values.

Figure 13 Scenarios of Policies to Mitigate Regional GHG Emissions

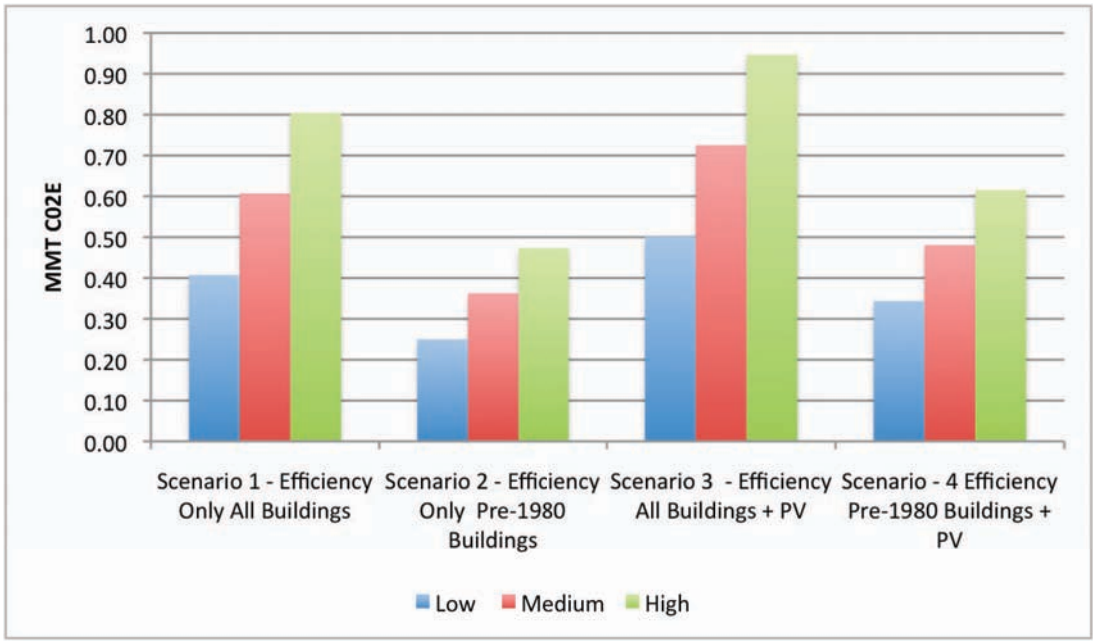


Figure 14 shows the medium level of savings for each local policy included and the amount of reductions that would be needed to reach the revised EPIC target.

[151] Section 8.2 of the Appendix provides emissions reduction values for each of the policy measures included in the four scenarios presented here.

Figure 14 Estimated GHG Emissions Reduction for Scenarios of Policies (2020)

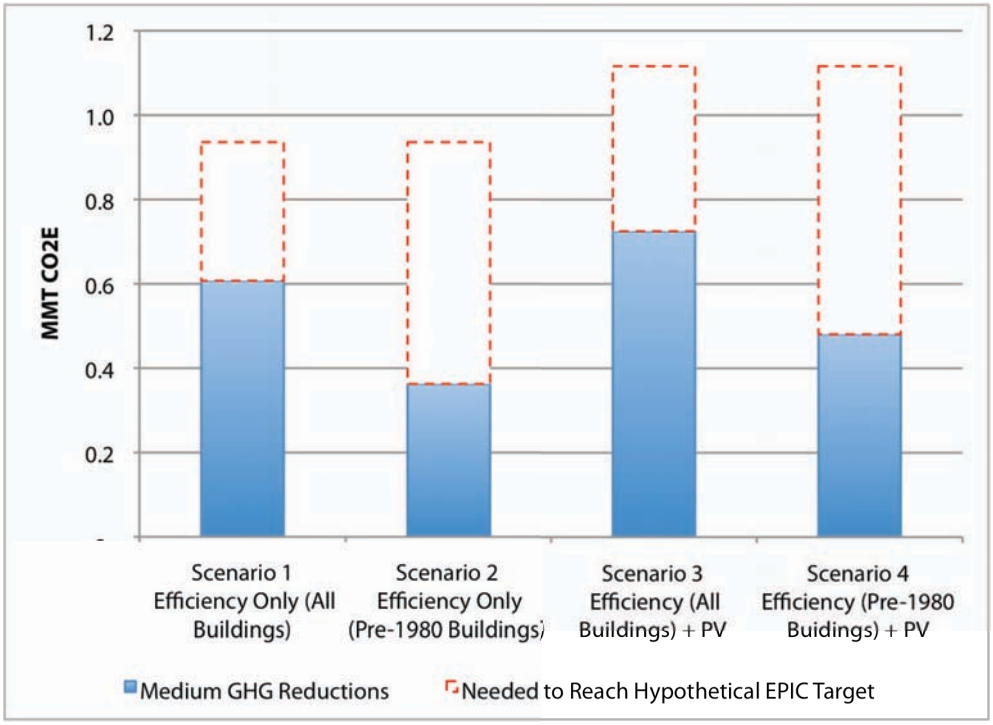


Table 22 provides the emissions reduction data for the four scenarios presented above. It includes data for the low, medium, and high GHG reductions calculations, differentiates between all buildings and those build prior to 1980, and provides total GHG reductions including and excluding solar photovoltaics.

Table 22 Summary of GHG Reduction Estimates (MMT CO_2E in 2020)

Existing Buildings - All[1]	**Low**	**Medium**	**High**
Residential Efficiency Retrofits (ALL)	0.10	0.14	0.19
Residential Solar Water Heating Retrofit (ALL)	0.07	0.09	0.11
Commercial Retro-Commissioning (ALL)	0.04	0.08	0.11
Commercial Efficiency Retrofits (ALL)	0.09	0.14	0.19
Total	**0.29**	**0.45**	**0.60**
Existing Buildings - Pre 1980[1]	**Low**	**Medium**	**High**
Residential Efficiency Retrofits (Pre-1980)	0.06	0.08	0.11
Residential Solar Water Heating Retrofit (Pre-1980)	0.04	0.05	0.06
Commercial Retro-Commissioning (Pre-1980)	0.01	0.02	0.04
Commercial Efficiency Retrofits (Pre-1980)	0.03	0.04	0.06
Total	**0.13**	**0.20**	**0.27**
New Construction[2]	**Low**	**Medium**	**High**
Enhanced Residential Building Codes	0.01	0.01	0.02
Residential Appliance Standards (New)	0.01	0.01	0.02
Residential Photovoltaics (New)	0.08	0.09	0.11
Residential Pre-Plumb (New)	0.01	0.01	0.01
Enhanced Commercial Building Codes (New)	0.02	0.04	0.06
Commercial Photovoltaics (New)	0.01	0.02	0.04
Total New Construction - no SOLAR	**0.04**	**0.08**	**0.11**
Total New Construction - with SOLAR	**0.14**	**0.20**	**0.25**
Scenario 1 - Efficiency Only All Buildings	0.33	0.52	0.71
Scenario 2 - Efficiency Only Pre-1980 Buildings	0.18	0.28	0.38
Scenario 3 - Efficiency All Buildings + PV	0.43	0.64	0.85
Scenario - 4 Efficiency Pre-1980 Buildings + PV	0.27	0.40	0.52

[1] Auditing and disclosure policy totals eliminated to avoid double counting with efficiency retrofits.

[2] Photovoltaic pre-wire policy eliminated to avoid double county with residential requirement.

6. CONCLUSIONS

Many policy options exist within the authority of local governments that can reduce community-wide GHG emissions. Of the policies analyzed in this study, all can be developed and implemented in the short term (1-2 years), most of the policies have been adopted by one or more local governments in California or the U.S., and several policies with a relatively low cost per metric ton of GHG reduction.

Based on preliminary quantitative analysis, one policy – commercial efficiency retrofits targeted at a percentage of all buildings – has a high potential to reduce emissions and a relatively low cost per unit of GHG reduction. Several policies have a moderate potential to reduce emissions and have a low implementation cost. These include: commercial retro-commissioning in a percentage of all buildings, commercial efficiency retrofits in buildings built prior to 1980, and enhanced new construction energy standards in commercial buildings.

Another policy – requiring Energy Star appliances in all new homes – has also has a low cost per unit of GHG reductions, though it has a relatively low potential to reduce emissions. With the exception of one policy with high potential for GHG reductions, all would target existing buildings. Further, of the energy efficiency policies assessed, those targeting existing buildings have a higher potential to reduce GHG emissions than those targeting new construction or solar photovoltaics.

Regardless of the relative cost of individual policy measures, to attain the levels of emissions reductions necessary to meet the hypothetical target of 1990 levels by 2020, it would be necessary to implement all policy options region wide or achieve similar reductions by other methods such as enhanced statewide building and appliance standards and expanded utility-administered energy efficiency programs. By extension, even more aggressive actions would be necessary to achieve significant reductions by 2050.

6.1. Recommendations for Further Research and Analysis

- Conduct a detailed analysis of the existing building stock in San Diego County to validate and refine the estimates developed in this report. At a minimum, it would be necessary to characterize the building stock by type (single family, multi-family, etc.), vintage, climate zone, etc.
- Conduct a more detailed cost analysis to validate and refine preliminary estimates and to account for any unique characteristics that may exist.
- Conduct analysis on the implications for regional electric and natural gas use of reducing regional emissions 80% below 1990 levels by 2050. This is the level of emissions reductions contained in California Executive Order S-3-05 and contemplated by federal legislation.
- Develop model policy language and supporting documentation for a subset of feasible policy options.

7. APPENDIX

7.1. Greenhouse Gas Calculation Methodology – Existing Buildings

The following general assumptions were used in estimating the GHG reduction potential and implementation cost for existing building policies.

- GHG intensity of electricity declines through 2020 as reduction measures are implemented.
- Transmission and distribution losses included in electricity savings amounts.
- GHG content of natural gas is 0.005 MMT CO_2E/MM therms.
- All energy consumption, housing, and building area data are scaled to SD County.

Table 23 present the assumptions used to calculate both reasonable GHG reduction potential and implementation costs. We recognize that many of the assumptions are based on averages and therefore obscure differences among subsectors. For example, the cost of energy efficiency retrofits likely differs by housing type (single family and multifamily), building age, and climate zone. Further analysis should be conducted to differentiate the GHG reduction potential and implementation costs among different building types, vintages, and locations to help craft policy and prioritize actions.

Table 23 Assumptions used to Estimate GHG Emissions and Cost for Existing Building Policies

Policy Measure	Annual Penetration Rate	Penetration of the Total Building Stock by 2020*		Total Number/Area of Buildings by 2020		Total Annual Energy Reduction (unless units specified)			Cost of GHG Reductions	Average Useful Life (years)	Assumptions/Notes
		All Buildings	*Pre 1980*	*All Buildings*	*Pre 1980*	*Low*	*Medium*	*High*			
Residential Energy Audit and Rating	3.5% receive audit 25% of audits conduct retrofits	37% (audits) 9% (retrofits)	22% (audits) 6% (retrofits)	460,359 (audits) 115,090 (retrofits	278,737 (audits) 69,684 (retrofits)	3%	7.5%	11%	$500/audit $1,000/retrofit	12	1. Adoption rate is constant through 2020 and is equal to the average number of home sales annually in SD County. 2. Savings rate applied to annual average consumption level. 3. Savings rate and audit cost data adapted from CEC 2005 study on existing building efficiency. 4. Based on CEC RASS report, 54% of total energy consumption is natural gas, 46% is electricity.
Residential Efficiency Upgrades	2%	21%	13%	263,062	159,278	10%	15%	20%	$2,500/retrofit $500/audit	12	1. Savings rate adapted from CEC 2005 study on existing building efficiency and Berkeley RECO information. 2. Cost estimate based on Berekely and San Francisco RECO cost caps, Consol estimate of Berkeley RECO costs, and Sustainable Spaces estimate for GHG reductions. 3. Based on CEC RASS report, 54% of total energy consumption is natural gas, 46% is electricity.
Residential Solar Water Heating Retrofit	0.80%	9%	5%	109,609	66,366	88 therms	117 therms	146 therms	$5,500/SWH	20	1. Assumes all solar water heaters offset natural gas. 2. Energy savings and cost values based on ITRON Evaluation of the SWH Pilot Project; CPUC Energy Division report on SWH PP (AB 1470).
Commercial Retro-Commissioning	2%	20%	14%	131 MM SF	45 MM SF	0.625 kWh/SF 0.013 therms/SF	1.25 kWh/SF 0.025 therms/SF	1.875 kWh/SF 0.038 therms/SF	$0.55/SF	10	1. Penetration, energy savings, and cost rates based on LBNL and CEC reports.
Commercial Efficiency Upgrades	2.0%	22%	8%	252 MM SF	86 MM SF	10%	15%	20%	$1.50/SF	12	1. Savings rate adapted from CEC 2005 study on existing building efficiency and Berkeley CECO savings information. 2. Cost based on SDG&E SPC program data for HVAC, lighting, and other categories. 3. Based on CEC Commercial End Use Survey, 35% of total energy consumption is natural gas, 65% is electricity.

*Totals do not equal penetration rate times 11 years, because the number and area of buildings varies each year. Values for pre-1980 bulidings show percentage of the total building stock in 2020.

7.2. Greenhouse Gas Calculation Methodology – New Construction

The same general assumptions listed in Section 7 were used in evaluating new construction policies. The following table presents the assumptions used to estimate the GHG reduction potential and cost for new construction policies.

Table 24 Assumptions used to Calculate GHG Emissions and Cost for New Construction Policies

Policy Measure	Annual Penetration Rate	Penetration of the Total Building Stock by 2020*	Total Number/Area (MM SF) of Buildings by 2020	Annual Energy Reduction / Production			Cost of GHG Reductions (medium scenario)	Useful Life	Assumptions/Notes
				Low	*Medium*	*High*			
Residential Enhanced Energy Buildings Standards	1%	6.0%	131,531	5% of total annual consumption	10% of total annual consumption	15% of total annual consumption	$1,250/home	12	1. 10% of average home's electric consumption is covered by Title 24. 2. 80% of average home's natural gas consumption is covered by Title 24. 3. Percentage consumption covered by T24 based on CEC RASS Study. 4. Percentage better than T24 is phased out and replaced with NZEH standard. No incremental savings from 2016-2020.
Residential Appliance Standard (Energy Star)	1%	11.0%	131,531	Refrigerator 111 kWh Dish Washer 25 kWh, 1 therm Wash. Machine 24 KWh, 10 therms			$200/home	12	1. Cost and energy savings estimates based on Energy Star Cost Calculator assumptions. Calculated value is $159. To be conservative, an incremental cost of $200 per home is used.
Residential Solar PV Pre-wire	1% get prewire % install PV varies	varies	varies	Energy saved based on10% of pre-wired homes install PV	Energy saved based on 15% of pre-wired homes install PV	Energy saved based on 20% of pre-wired homes install PV	$300/home $7,796/kW (average 2010 to 2020)	20	1. 17% capacity factor 2. Cost estimate is average based on $0.25/yr/W reduction until 2015 and a $0.15/yr reductino until 2020. This is reduced from $9.41 statewide cost of CSI in 2008.
Residential Solar PV Mandate	1% homes is target 15% install PV varies based on exemptions	varies	varies	Energy savigs based on 65% of new homes install PV	Energy savigs based on 75% of new homes install PV	Energy savigs based on 85% of new homes install PV	$7,796/kW (average 2010 to 2020)	20	1. 17% capacity factor 2. GHG savings accrue to CSI program 3. Policy allows exemptions 4. Cost estimate is average based on $0.25/yr/W reduction until 2020. This is reduced from $9.41 statewide cost of CSI in 2008.
Residential Solar Water Heater Pre-plumb	1% get pre-plumb 15% install SWH	11%	131,531pre-plumb 19,730 install SWH	88 therms	117 therms	146 therms	$450 for pre-plumb $5,200/SWh	20	1. Assumes solar water will offset natural gas water heating. 2. Savings rates based on ITRON report on CCSE SWH Pilot Program. 3. Cost estiamate is 80% of retrofit cost and assumes economies of scale.
Commercial Enhanced Energy Buildings Standards	2%	20%	133 MM SF	5%	10%	15%	$1.00/SF	12	1. Based on CEC Commercial End Use Survey, 65% of average commercial energy use is natural gas, 35% is electric. . 2. Based on CEC End Use Survey, 70% of both natural gas and electric consumption are regulated by Title 24. 3. Required percent better than T24 phased out as T24 standard becomes stricter. No incremental savings after 2018. 4. Cost estimates based on local government proposals to enhance T24 standards.
Commecial Solar PV Mandate	2% targetted 75% install solar PV	15%	133 MM SF targeted 100 MM SF install PV	2.5 kW/10,000 SF	5 kW/10,000 SF	10 kW/10,000 SF	$6,526/kW	20	1. 17% capacity factor 2. PV capacity adapted from existing City of Culver City policy (1kW/10,000SF). 3. Cost estimate is average based on $0.25/yr/W reduction until 2015 and a $0.15/yr reductino until 2020. This is reduced from $8.41 statewide cost of CSI in 2008.

7.3. Greenhouse Gas Calculation Method – Common Data Used

Table 25 provides the building and energy data used to estimate the GHG reduction and cost for the policies included in this report.

Table 25 Building and Energy Data Used for GHG Reduction and Cost Estimates

Year	Commercial Building Floorspace SD County ONLY (0.91 ot total SDG&E Service Territory) MM SF	Residential Dwelling Units	Average Residential Electricity Consumption SD County (CEC consumption + losses) kWh/Residential Unit	Average Natural Gas Consumption SD County MM Therms/Residential Unit	Average Commercial Electricity Consumption SD County Only (CEC Consumption + Losses) kWh/SF	Average Commercial Natural Gas Consumption SD County Only Therms/SF
1990	337	946,240	6,124	357	16.8	0.35
1991	355	958,859	5,911	348	15.6	0.35
1992	367	971,345	6,133	321	16.6	0.35
1993	375	980,395	6,001	331	16.2	0.42
1994	382	986,983	6,133	344	16.2	0.26
1995	388	993,705	6,076	313	16.3	0.28
1996	395	999,944	6,225	311	16.9	0.26
1997	402	1,006,882	6,341	306	17.9	0.39
1998	410	1,014,858	6,450	339	17.4	0.28
1999	422	1,026,142	6,481	359	17.8	0.29
2000	436	1,040,149	6,455	315	19.3	0.18
2001	451	1,048,699	5,973	315	16.4	0.30
2002	465	1,063,371	6,081	306	16.6	0.30
2003	477	1,078,416	6,392	286	17.0	0.29
2004	488	1,095,077	6,610	299	17.7	0.29
2005	500	1,108,500	6,544	276	17.3	0.29
2006	507	1,121,527	6,845	294	17.7	0.29
2007	517	1,134,854	6,792	279	17.5	0.27
2008	528	1,147,900	6,890	271	17.6	0.27
2009	538	1,151,296	6,792	261	16.9	0.25
2010	545	1,154,291	6,789	261	16.8	0.25
2011	552	1,158,786	6,784	261	16.7	0.26
2012	560	1,164,882	6,805	262	16.9	0.26
2013	570	1,171,977	6,828	262	16.9	0.26
2014	582	1,180,976	6,835	263	16.8	0.26
2015	593	1,191,879	6,849	264	16.7	0.26
2016	603	1,203,061	6,850	264	16.6	0.26
2017	612	1,214,574	6,860	265	16.5	0.26
2018	622	1,226,175	6,873	265	16.4	0.26
2019	631	1,237,630	6,893	266	16.4	0.26
2020	640	1,248,874	6,912	267	16.3	0.26
Median			6,610	286	16.8	0.27
Average			6,533	295	16.9	0.29

7.4. Energy Price Data

Table 26 presents the energy prices used for the implementation cost estimates for the policies evaluated in this report.

Table 26 Energy Price Data Use for Costs Estimate Calculations

Year	Residential Electricity ($/kWh)	Residential Natural Gas ($/therm)	Commercial Electricity ($/kWh)	Commercial Natural Gas ($/therm)
1990	$0.14	$0.29	$0.16	$0.83
1991	$0.13	$0.28	$0.16	$0.48
1992	$0.13	$0.28	$0.16	$0.48
1993	$0.13	$0.29	$0.16	$0.46
1994	$0.13	$0.30	$0.17	$0.43
1995	$0.12	$0.29	$0.16	$0.33
1996	$0.14	$0.30	$0.16	$0.39
1997	$0.13	$0.31	$0.13	$0.44
1998	$0.12	$0.32	$0.14	$0.48
1999	$0.12	$0.33	$0.13	$0.53
2000	$0.15	$0.34	$0.13	$0.65
2001	$0.14	$0.53	$0.16	$1.18
2002	$0.14	$0.28	$0.15	$0.39
2003	$0.14	$0.34	$0.14	$0.63
2004	$0.16	$0.36	$0.14	$0.69
2005	$0.16	$0.39	$0.13	$0.76
2006	$0.18	$0.39	$0.13	$0.57
2007	$0.17	$0.39	$0.14	$0.58
2008	$0.16	$0.51	$0.14	$0.75
2009	$0.16	$0.37	$0.14	$0.54
2010	$0.16	$0.37	$0.14	$0.54
2011	$0.16	$0.37	$0.14	$0.55
2012	$0.16	$0.37	$0.14	$0.55
2013	$0.16	$0.38	$0.14	$0.56
2014	$0.17	$0.38	$0.14	$0.56
2015	$0.17	$0.38	$0.15	$0.57
2016	$0.17	$0.39	$0.15	$0.57
2017	$0.17	$0.39	$0.15	$0.58
2018	$0.18	$0.40	$0.15	$0.58
2019	$0.18	$0.40	$0.16	$0.59
2020	$0.18	$0.40	$0.16	$0.60
2021	$0.18	$0.41	$0.16	$0.60
2022	$0.19	$0.41	$0.16	$0.61
2023	$0.19	$0.41	$0.16	
2024	$0.19	$0.42	$0.17	
2025	$0.20	$0.42	$0.17	
2026	$0.20	$0.43	$0.17	
2027	$0.20	$0.43	$0.17	
2028	$0.20	$0.43	$0.18	
2029	$0.21	$0.44	$0.18	
2030	$0.21	$0.44	$0.18	

Source: California Energy Commission, California Energy Demand 2010-2020, Staff Forecast. Final September 2009.

7.5. Cost Method and Results

Implementation costs for the policies evaluated here were estimated using per-unit costs derived from actual data or published reports and studies, average useful life data from the California Database for Energy Efficient Resources (DEER)[152], energy price data from the CEC, and penetration rates used to estimate GHG reductions. Details on the values used for these calculations are presented above in Tables 23-26. To capture the differences among the useful life of the measures evaluated in this study and to enable comparison across policies, we calculated the net present value (NPV) of each policy over its useful life with a 5% discount rate. For example, NPV calculations for energy efficiency covered a 12-year life, for solar water heating 20 years, and for solar photovoltaics 20 years. Because this study evaluates policies that are implemented annually from 2010 to 2020 and that savings from measures implemented in 2019 will produce GHG reductions for another 10-20 years beyond the 2020 time horizon, for AB 32 compliance, we used average annual implementation costs and customers savings to derive a NPV value. This also allows cost estimates to reflect any potentially declining implementation costs and the GHG-intensity of electricity.

The results of the NPV calculation were used to develop a ratio of cost per metric ton CO_2E, which normalizes cost and allows for comparisons of policy costs. The study estimates cost per metric ton of CO_2E using the net present value for cost.

The costs considered in this report represent the total implementation cost and do not include any financial subsidy such as tax credits or rebates. Subtracting such incentives from the total implementation cost likely will reduce the actual cost paid by homeowners and businesses, thus potentially affecting the economics of specific projects, however such subsidies do not reduce the overall cost of implementation. Results of the cost calculations are presented below in Table 27.

Table 27 Cost Evaluation Results

Local Government Policy Measure	Average Annual Implementation Cost	Annual Customer Savings	NPV @ 5%	Useful Life	Total GHG Reduction (MT CO_2E)*	NPV/MT CO_2E
Commercial Retro-Commissioning	$ (6,355,410)	$ 2,317,710	$ 12,282,330	10	75,161	$ 163
Commercial Efficiency Retrofits	$ (17,896,488)	$ 4,443,638	$ 20,465,332	12	141,683	$ 144
Residential Appliance Standards (New)	$ (2,402,250)	$ 376,977	$ 894,283	12	15,541	$ 58
Enhanced Commercial Building Codes (New)	$ (11,640,437)	$ 1,105,504	$ (1,754,358)	12	37,303	$ (47)
Residential Efficiency Retrofits	$ (72,067,488)	$ 4,515,209	$ (30,521,954)	12	155,522	$ (196)
Residential Solar Water Heating Retrofit	$ (66,151,035)	$ 2,308,075	$ (35,606,966)	20	147,183	$ (242)
Commercial Photovoltaics (New)	$ (28,194,990)	$ 1,125,291	$ (13,496,547)	20	43,423	$ (311)
Residential Photovoltaics (New)	$ (124,385,024)	$ 5,083,742	$ (58,124,149)	20	170,066	$ (342)
Residential Pre-Wire (New)	$ (28,603,253)	$ 1,016,748	$ (15,173,638)	20	34,013	$ (446)
Residential Rating/Disclosure	$ (31,529,526)	$ 988,425	$ (21,684,634)	12	34,020	$ (637)
Residential Pre-Plumb (New)	$ (17,402,811)	$ 76,786	$ (15,662,748)	15	21,095	$ (743)
Enhanced Residential Building Codes (New)	$ (13,333,250)	$ 166,108	$ (11,296,186)	12	14,438	$ (782)

*GHG values here represent total emissions reductions over the useful life of the measure.

[152] The Database for Energy Efficient Resources (DEER) is a California Energy Commission and California Public Utilities Commission (CPUC) sponsored database designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life (EUL). The DEER is *available at* http://www.energy.ca.gov/deer/.

7.5.1. Cost Categories

Based on the results in Table 27, we divided policies into three cost categories: low, medium, and high. The range of costs that constitute the medium category was determined by adding and subtracting one-half of one standard deviation from the mean value. Those policies with costs below one-half a standard deviation from the mean were considered the "low" category, those with a cost above one-half a standard deviation from the mean were considered the "high" category. Table 28 presents the low, medium, and high categorization of the policies evaluated.

Table 28 Cost Categories for Policies Evaluated

Policy or Measure	Cost of GHG Reduction (NPV$/MT CO_2E)	Cost Category
Commercial Retro-Commissioning	163	Low
Commercial Efficiency Retrofits	144	Low
Residential Appliance Standards (New)	58	Low
Enhanced Commercial Building Codes (New)	-47	Low
Residential Efficiency Retrofits	-196	Medium
Residential Solar Water Heating Retrofit	-242	Medium
Commercial Photovoltaics (New)	-311	Medium
Residential Photovoltaics (New)	-342	Medium
Residential Pre-Wire (New)	-446	High
Residential Rating/Disclosure	-637	High
Residential Pre-Plumb (New)	-743	High
Enhanced Residential Building Codes (New)	-782	High

13

Policies, Instruments and Co-operative Arrangements

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EXECUTIVE SUMMARY

This chapter synthesizes information from the relevant literature on policies, instruments and co-operative arrangements, focusing mainly on new information that has emerged since the Third Assessment Report (TAR). It reviews national policies, international agreements and initiatives of sub-national governments, corporations and non-governmental organizations (NGOs).

National policies

The literature on climate change continues to reflect the wide variety of national policies and measures that are available to governments to limit or reduce greenhouse gas (GHG) emissions. These include regulations and standards, taxes and charges, tradable permits, voluntary agreements, subsidies, financial incentives, research and development programmes and information instruments. Other policies, such as those affecting trade, foreign direct investment, consumption and social development goals, can also affect GHG emissions. Climate change policies, if integrated with other government polices, can contribute to sustainable development in developed and developing countries alike.

Reducing emissions across all sectors and gases requires a portfolio of policies tailored to fit specific national circumstances. While the advantages and disadvantages of any one given instrument can be found in the literature, four main criteria are widely used by policymakers to select and evaluate policies: environmental effectiveness, cost-effectiveness, distributional effects (including equity) and institutional feasibility. Other more specific criteria, such as effects on competitiveness and administrative feasibility, are generally subsumed within these four.

The literature provides a great deal of information for assessing how well different instruments meet these criteria, although it should be kept in mind that all instruments can be designed well or poorly and to be stringent or lax and politically attractive or unattractive. In addition, all instruments must be monitored and enforced to be effective. The general conclusions that can be drawn from the literature are that:

- Regulatory measures and standards generally provide some certainty of emissions levels, but their environmental effectiveness depends on their stringency. They may be preferable when information or other barriers prevent firms and consumers from responding to price signals (*high agreement/much evidence*).
- Taxes and charges are generally cost-effective, but they cannot guarantee a particular level of emissions, and they may be politically difficult to implement and, if necessary, adjust. As with regulations, their environmental effectiveness depends on stringency (*high agreement/much evidence*).
- Tradable permits can establish a carbon price. The volume of allowed emissions determines the carbon price and the environmental effectiveness of this instrument, while the distribution of allowances can affect cost-effectiveness and competitiveness. Experience has shown that banking provisions can provide significant temporal flexibility (*high agreement/much evidence*). Uncertainty in the price of carbon makes it difficult to estimate the total cost of meeting emission reduction targets.

Voluntary agreements (VAs) between industry and governments, which vary considerably in scope and stringency, are politically attractive, raise awareness among stakeholders and have played a role in the evolution of many national policies. A few have accelerated the application of best available technology and led to measurable reductions of emissions compared to the baseline, particularly in countries with traditions of close cooperation between government and industry. However, there is little evidence that VAs have achieved significant reductions in emissions beyond business as usual (*high agreement/much evidence*). The successful programmes all include clear targets, a baseline scenario, third party involvement in design and review and formal provisions for monitoring.

- Financial incentives are frequently used by governments to stimulate the diffusion of new, less GHG-emitting technologies. While economic costs are generally higher for these than for other instruments, financial incentives are often critical to overcoming the barriers to the penetration of new technologies (*high agreement/much evidence*). Direct and indirect subsidies for fossil fuel use and agriculture remain common practice, although those for coal have declined over the past decade in many Organization for Economic Co-operation and Development (OECD) and in some developing countries.
- Government support through financial contributions, taxation measures, standard setting and market creation is important to the promotion of technology development, innovations and transfer. However, government funding for many energy research programmes has fallen off since the oil shock in the 1970s and stayed constant at this lower level, even after the United Nations Framework Convention on Climate Change (UNFCCC) was ratified. Substantial additional investments in – and policies for – Research and Development (R&D) are needed to ensure that technologies are ready for commercialization in order to arrive at a stabilization of GHGs in the atmosphere (see Chapter 3), as are economic and regulatory instruments to promote their deployment and diffusion (*high agreement/much evidence*).
- Information instruments, including public disclosure requirements, may affect environmental quality by promoting better-informed choices and lead to support for government policy. There is only limited evidence that the provision of information can achieve emissions reductions, but it can improve the effectiveness of other policies (*high agreement/medium evidence*).

In practice, climate-related policies are seldom applied in complete isolation, as they overlap with other national polices relating to the environment, forestry, agriculture, waste management, transport and energy and, therefore, in many cases require more than one instrument. For an environmentally effective and cost-effective instrument mix to be applied, there must be a good understanding of the environmental issue to be addressed, the links with other policy areas and the interactions between the different instruments in the mix. Applicability in specific countries, sectors and circumstances – particularly developing countries and economies in transition – can vary greatly, but may be enhanced when instruments are adapted to local circumstances (*high agreement/much evidence*).

International agreements

As precedents, the UNFCCC and Kyoto Protocol have been significant in providing a means to solve a long-term international environmental problem, but they are only first steps towards the implementation of an international response strategy to combat climate change. The Kyoto Protocol's most notable achievements are the stimulation of an array of national policies, the creation of a carbon market and the establishment of new institutional mechanisms. Its economic impacts on the participating countries are yet to be demonstrated. The Clean Development Mechanism (CDM), in particular, has created a large project pipeline and mobilized substantial financial resources, but it has faced methodological challenges in terms of determining baselines and additionality. The Protocol has also stimulated the development of emissions trading systems, but a fully global system has not been implemented. The Kyoto Protocol is currently constrained by the modest emission limits. It would be more effective if the first commitment period is followed-up by measures to achieve deeper reductions and the implementation of policy instruments covering a higher share of global emissions (*high agreement/much evidence*).

New literature highlights the options for achieving emission reductions both under and outside of the Convention and its Kyoto Protocol by, for example, revising the form and stringency of emission targets, expanding the scope of sectoral and sub-national agreements, developing and adopting common policies, enhancing international Research, Development and Demonstration (RD&D) technology programmes, implementing development-oriented actions and expanding financing instruments (*high agreement/much evidence*). An integration of diverse elements, such as international R&D co-operation and cap and trade programmes, within an agreement is possible, but any comparison of the efforts made by different countries would be complex and resource-intensive (*medium agreement/medium evidence*).

Recent publications examining future international agreements in terms of potential structure and substance report that because climate change is a global problem, any approach that does not include a larger share of global emissions will have a higher global cost or be less environmentally effective (*high agreement/much evidence*). The design of a future regime will have significant implications for global costs and the distribution of cost among regions at different points in time There is a broad consensus in the literature that a successful agreement will have to be environmentally effective and cost-effective, incorporate distributional considerations and equity and be institutionally feasible (*high agreement/much evidence*). Agreements are more likely to be effective if they include goals, specific actions, timetables, participation and institutional arrangements and provisions for reporting and compliance (*high agreement/much evidence*).

Goals determine the extent of participation, the stringency of the measures and the timing of the actions. For example, to limit the temperature increase to 2°C above pre-industrial levels, developed countries would need to reduce emissions in 2020 by 10–40% below 1990 levels and in 2050 by approximately 40–95%. Emissions in developing countries would need to deviate below their current path by 2020, and emissions in all countries would need to deviate substantially below their current path by 2050. A temperature goal of less than 2°C requires earlier reductions and greater participation (and vice versa) (*high agreement/much evidence*). Abatement costs depend on the goal, vary by region and depend on the allocation of emission allowances among regions and the level of participation.

Initiatives of local and regional authorities, corporations, and non-governmental organizations

Corporations, local and regional authorities and NGOs are adopting a variety of actions to reduce GHG emissions. Corporate actions range from voluntary initiatives to emissions targets and, in a few cases, internal trading systems. The reasons corporations undertake independent actions include the desire to influence or pre-empt government action, to create financial value, and to differentiate a company and its products. Actions by regional, state, provincial and local governments include renewable energy portfolio standards, energy efficiency programmes, emission registries and sectoral cap and trade mechanisms. These actions are undertaken to influence national policies, address stakeholder concerns, create incentives for new industries and/or to create environmental co-benefits. Non-government organizations promote programmes that reduce emissions through public advocacy, litigation and stakeholder dialogue. Many of the above actions may limit GHG emissions, stimulate innovative policies, encourage the deployment of new technologies and spur experimentation with new institutions, but they generally have limited impact on their own. To achieve significant emission reductions, these actions must lead to changes in national policies (*high agreement/medium evidence*).

Implications for global climate change policy

Climate change mitigation policies and actions taken by national governments, the private sector and other areas of civil society are inherently interlinked. For example, significant emissions reductions have occurred as a result of actions by

governments to address energy security or other national needs (e.g. the switch in the UK to gas, the energy efficiency programmes of China and India, the Brazilian development of a transport fleet driven by bio-fuel or the trend in the 1970s and 1980s toward nuclear power). However, non-climate policy priorities can overwhelm climate mitigation efforts (e.g. decisions in Canada to develop the tar sands reserves, those in Brazil to clear forests for agriculture and in the USA to promote coal power to enhance energy security) and lead to increased emissions. New research to assess the interlinkages between climate change and other national policies and actions might lead to more politically feasible, economically attractive and environmentally beneficial outcomes and international agreements.

13.1 Introduction

Article 4 of the United Nations Framework Convention on climate change (UNFCCC) commits all Parties – taking into account their common but differentiated responsibilities and their specific national and regional priorities, objectives and circumstances – to formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures that will result in the mitigation of climate change by addressing anthropogenic emissions of greenhouse gases (GHGs) by sources and removals by sinks. The main purpose of this chapter is to discuss national policy instruments and their implementation, international agreements and other arrangements and initiatives of the private sector, local governments and non-governmental organizations (NGOs). This chapter expands on the literature that has emerged since the Third Assessment Report (TAR) – in particular, on aspects covered in Chapters 6 and l0 of the TAR. There is a relatively heavier focus given to publications proposing new approaches to possible future international agreements, alternative options for international cooperation and initiatives of local governments and the private sector. Wherever feasible, these agreements and arrangements are discussed in the context of criteria such as environmental effectiveness, cost-effectiveness, distributional considerations, institutional feasibility, among others. This chapter does not discuss in detail either sectoral policies, which can be found in other chapters of this report, or adaptation policies, as those may be found in IPCC (2007b).

13.1.1 Types of policies, measures, instruments and co-operative arrangements

A variety of policies, measures, instruments and approaches are available to national governments to limit the emission of GHGs; these include regulations and standards, taxes and charges, tradable permits, voluntary agreements (VAs), informational instruments, subsidies and incentives, research and development and trade and development assistance. Box 13.1 provides a brief definition of each instrument (Hahn, 2001; Sterner, 2003). Depending on the legal framework within which each individual country must operate, these may be implemented at the national level, sub-national level or through bi-lateral or multi-lateral arrangements, and they may be either legally binding or voluntary and either fixed or changeable (dynamic).

Box 13.1 Definitions of selected GHGs abatement policy instruments

Note: The instruments defined below to directly control GHG emissions; instruments may also be used to manage activities that indirectly lead to GHG emissions, such as energy consumption.

Regulations and Standards: These specify the abatement technologies (technology standard) or minimum requirements for pollution output (performance standard) that are necessary for reducing emissions.

Taxes and Charges: A levy imposed on each unit of undesirable activity by a source.

Tradable Permits: These are also known as marketable permits or cap-and-trade systems. This instrument establishes a limit on aggregate emissions by specified sources, requires each source to hold permits equal to its actual emissions and allows permits to be traded among sources.

Voluntary Agreements: An agreement between a government authority and one or more private parties with the aim of achieving environmental objectives or improving environmental performance beyond compliance to regulated obligations. Not all VAs are truly voluntary; some include rewards and/or penalties associated with participating in the agreement or achieving the commitments.[1]

Subsidies and Incentives: Direct payments, tax reductions, price supports or the equivalent thereof from a government to an entity for implementing a practice or performing a specified action.

Information Instruments: Required public disclosure of environmentally related information, generally by industry to consumers. These include labelling programmes and rating and certification systems.

Research and Development (R&D): Activities that involve direct government funding and investment aimed at generating innovative approaches to mitigation and/or the physical and social infrastructure to reduce emissions. Examples of these are prizes and incentives for technological advances.

Non-Climate Policies: Other policies not specifically directed at emissions reduction but which may have significant climate-related effects.

1 Voluntary Agreements (VAs) should not be confused with voluntary actions which are undertaken by govern-ment agencies at the sub-national level, corporations, NGOs and other organizations independent of national government authorities. See Section 13.4.

13.1.2 Criteria for policy choice

Four principal criteria for evaluating environmental policy instruments are reported in the literature; these are:

- Environmental effectiveness – the extent to which a policy meets its intended environmental objective or realizes positive environmental outcomes.
- Cost-effectiveness – the extent to which the policy can achieve its objectives at a minimum cost to society.
- Distributional considerations – the incidence or distributional consequences of a policy, which includes dimensions such as fairness and equity, although there are others.
- Institutional feasibility – the extent to which a policy instrument is likely to be viewed as legitimate, gain acceptance, adopted and implemented.

It has to be mentioned, however, that literature in the fields of economics and political science does not provide much guidance in terms of determing which evaluative criteria are the most appropriate for an analysis of environmental policy. However, many authors employ criteria similar to the ones listed above, and although other criteria may also be important in evaluating policies, the analysis presented in this chapter is limited to these four criteria. Criteria may be applied by governments in making ex ante choices among instruments and in ex post evaluation of the performance of instruments.

13.1.2.1 Environmental effectiveness

The main goal of environmental policy instruments and international agreements is to reduce the negative impact of human action on the environment. Policies that achieve specific environmental quality goals better than alternative policies can be said to have a higher degree of environmental effectiveness. It should be noted that although climate protection is the ostensible environmental goal for any climate policy, there may be ancillary environmental benefits (for example, those demonstrated by Burtraw *et al*. (2001a) for air pollution benefits; see also Section 4.5.2. for air quality co-benefits).

The environmental effectiveness of any policy is contingent on its design, implementation, participation, stringency and compliance. For example, a policy that seeks to fully address the climate problem while dealing with only some of the GHGs or some of the sectors will be relatively less effective than one that aims at addressing all gases and all sectors.

The environmental effectiveness of an instrument can only be determined by estimating how well it is likely to perform. Harrington *et al*. (2004) distinguish between estimating how effective an environmental instrument will be ex ante and evaluating its performance ex post. These researchers were able to find or recreate ex ante estimates of expected emissions reductions in a series of U.S. and European case studies. Their comparison of the ex ante and ex post observations suggests a reasonable degree of accuracy in the estimates, with those cases in which emissions reductions were greater than expected involving incentive-based instruments, while the cases in which reductions fell short of expectations involved regulatory approaches.

There are situations in which standards are proven to be effective. Regulators may be unduly pessimistic about the environmental performance of incentive-based instruments or unduly optimistic about the performance of regulatory approaches, or perhaps both. Recent evidence suggests that market-based approaches can provide equal if not superior environmental quality improvements over regulatory approaches (see Ellerman, 2006). As we discuss below, however, institutional constraints may alter the relative efficacy of market- and standards-based instruments.

13.1.2.2 Cost-effectiveness

The cost-effectiveness of a policy is a key decision parameter in a world with scarce resources. Given a particular environmental quality goal, the most cost-effective policy is the one which achieves the desired goal at the least cost. There are many components of cost, and these include both the direct costs of administering and implementing the policy as well as indirect costs, such as how the policy drives cost-reducing technological change.

Cost-effectiveness is distinct from general economic efficiency. Whereas cost-effectiveness takes an environmental goal as given, efficiency involves the process of selecting a specific goal according to economic criteria (Sterner, 2003). Consequently, the choice of a particular environmental goal will likely have dramatic impacts on the overall cost of a policy, even if that policy is implemented using the most cost-effective instrument.

Policies are likely to vary considerably in terms of cost-effectiveness, and any estimation of the costs involved can be challenging (Michaelowa, 2003b). While cost-effectiveness estimates traditionally include the direct expenditures incurred as a result of implementing any specific policy, the policy may also impose indirect social costs, which are more difficult to measure (Davies and Mazurek, 1998). Moreover, costs for which data are limited are often ignored. Harrington *et al*. (2000) provide a summary of commonly excluded costs as well as examples of efforts to estimate these.

Cost-effectiveness can be enhanced with low transaction costs for compliance. This implies limiting the creation of new institutions and keeping implementation procedures as simple as possible while still ensuring system integrity. Studies reported in the literature can be divided into two categories in terms of the economic impacts of the timing of reductions. While some researchers argue that reductions should be postponed until low-cost technologies are available, others argue that necessary decisions have to be made today to avoid a 'lock-in' to an

emission intensive pathway that would be expensive to leave at a later time point (see also Chapter 11).

A common concern is that ex ante cost estimates may not reflect the actual costs of a policy when it is assessed from an ex post perspective. Harrington *et al*. (2000) show that the discrepancy between the actual and estimated total costs of 28 environmental regulations in the USA is relatively low and, if anything, that ex ante estimates tend to overstate total costs. While these authors do not systematically evaluate specific environmental instruments, they do find that estimates for market-based instruments tend to overstate unit costs, while unit-costs estimates for other instruments are neither under- nor overestimates.

13.1.2.3 Distributional considerations

Policies rarely apportion environmental benefits and costs evenly across stakeholders. Even if a policy meets an environmental goal at least cost, it may face political opposition if it disproportionately impacts – or benefits – certain groups within a society, across societies or across generations. From an economic perspective, a policy is considered to be beneficial if it improves social welfare overall. However, this criterion does not require that the implementation of that policy actually improves the specific situation of any one individual. Consequently, as Keohane *et al*. (1998) argue, distributional considerations may be more important than aggregate cost effectiveness when policymakers evaluate an instrument.

The distributional considerations of climate change policies relate largely to equity. Equity can be defined in a number of ways within the climate context (see IPCC, 2001). Equity and fairness may be perceived differently by different people, depending on the cultural background of the observer. For example, Ringius *et al*. (2002) view responsibility, capacity and need as the basic principles of fairness that seem to be sufficiently widely recognized to serve as a normative basis for a climate policy regime. These three principles have been used in the evaluation of potential international climate agreements (e.g. Torvanger *et al*., 2004).

A regulation that is perceived as being unfair or for which the incidence is unbalanced may have a difficult time making it through the political process.[2] However, distributional considerations are fundamentally subjective, and the most equitable policy may not be the most politically popular one. For example, a policy that focuses the regulatory burden on a low-income subpopulation or country but directs the benefits to a wealthy interest group may sail with ease through the political process. While highly inequitable in costs and benefits, such an instrument is occasionally attractive to politicians. Bulkeley (2001) describes the different interests in the Australian climate policy debate and suggests that industrial emitters managed to steer the country away from ambitious reduction target – and toward an emissions increase – at the third Conference of the Parties in Kyoto.

Due to the fact that there is little consensus as to what constitutes optimal distribution, it can be difficult to compare – let alone rank – environmental policies based on distributional criteria (Revesz and Stavins, 2006). One exception is provided by Asheim *et al*. (2001), who construct an axiom of equity which, they argue, can be used to evaluate sustainability.[3] However, while sustainability may be important when evaluating environmental policies, it only captures the inter-generational dimension of distribution and is imperfectly related to political acceptability.

13.1.2.4 Institutional feasibility

Institutional realities inevitably constrain environmental policy decisions. Environmental policies that are well adapted to existing institutional constraints have a high degree of institutional feasibility. Economists traditionally evaluate instruments for environmental policy under ideal theoretical conditions; however, those conditions are rarely met in practice, and instrument design and implementation must take political realities into account. In reality, policy choices must be both acceptable to a wide range of stakeholders and supported by institutions, notably the legal system. Other important considerations include human capital and infrastructure as well as the dominant culture and traditions. The decision-making style of each nation is therefore a function of its unique political heritage. Box 13.2 provides an example for one country, taken largely from OECD (2005c).

Certain policies may also be popular due to institutional familiarity. Although market-based instruments are becoming more common, they have often met with resistance from environmental groups. Market-based instruments continue to face strong political opposition, even in the developed world, as demonstrated by environmental taxes in the USA or Europe. Regulatory policies that are outside of the norm of society will always be more difficult to put into effect (e.g. speed limits in Germany, or private sector participation in water services in Bolivia).

Another important dimension of institutional feasibility deals with implementing policies once they have been designed and adopted. Even if a policy receives political support, it may be difficult to implement under certain bureaucratic structures.

2 The United States has acknowledged the role of distribution explicitly through Executive Order 12878 (1994), which requires federal agencies to address environmental justice in their missions and activities.

3 For a summary of the economic literature on sustainability and intergenerational equity, see Pezzey and Toman (2002).

Box 13.2 The UK climate change levy: a study in political economy

The UK has a tradition of action on climate change that dates from the early acceptance of the problem by the Conservative Prime Minister Margaret Thatcher in 1988. The Labour government in 1997 reaffirmed the commitment to act and to use market-based instruments wherever possible; however, it voiced concerns on two aspects of this commitment: Firstly, that such measures might have a disproportionate effect on the poor which, in turn, might affect the coal mining communities (an important constituency) and, secondly, that this commitment might perpetuate a perception that the Labour government was committed to high taxes.

A key element of the UK's climate policy is a climate levy. The levy is paid by energy users – not extractors or generators – is levied on industry only and aims to encourage renewable energy. An 80% discount can be secured if the industry in question participates in a negotiated 'climate change agreement' to reduce emissions relative to an established baseline. Any one company over-complying with its agreement can trade the resulting credits in the UK emissions trading scheme, along with renewable energy certificates under a separate renewable energy constraint on generators. However, a number of industrial emitters wanted a heavier discount and, through lobbying, they managed to have a voluntary emissions trading scheme established that enables companies with annual emissions above 10,000 tCO_2-eq to bid for allocation of subsidies. The "auction" offered payments of 360 million €and yielded a de-facto payment of 27 € per tonne of CO_2. Thus, the trading part of the scheme has design elements that strongly reflect the interest groups involved (Michaelowa, 2004). The levy itself has limited coverage and, consequently, households, and energy extractors and generators have no incentive to switch to low carbon fuels. However, its design does take household vulnerability, competitiveness concerns and the sensitivity of some sectoral interests into account. Thus, while the levy has contributed to emission reduction, it has not been as effective as a pure tax; a pure tax may not have been institutionally feasible.

13.2 National policy instruments, their implementation and interactions

The policy-making process of almost all governments consists of complex choices involving many stakeholders, including the potential regulated industry, suppliers, producers of complementary products, labour organizations, consumer groups and environmental organizations. The choice and design of virtually any instrument has the potential to benefit some of these stakeholders and to harm others. For example, permits allocated free to existing firms represent a valuable asset transferred from the government to industry, while auctioned permits and taxes generally impose heavier burdens on polluters. As a result, it is likely that a candidate instrument will likely face both support and opposition from the stakeholders. Voluntary measures are often favoured by industry because of their flexibility and potentially lower costs, but these are often opposed by environment groups because of their lack of accountability and enforcement. In practice, policies may be complementary or opposing; moreover, the political calculus used to choose a particular instrument differs for each government.[4]

In formulating a domestic climate policy programme, a combination of policy instruments may work better in practice than reliance on a single instrument. Furthermore, an instrument that works well in one country may not work well in another country with different social norms and institutions. When instruments are to be compared, it is important that the different levels of stringency be taken into consideration and adjusted, for all of the instruments described herein may be set at different levels of stringency. Regulations will also undoubtedly need to be adjusted over time. All instruments must be supplemented with a workable system of monitoring and enforcement. Furthermore, instruments may interact with existing institutions and regulations in other sectors of society.

13.2.1 Climate change and other related policies

In this section we consider a number of instruments that have been used to manage environmental problems in different parts of the world. Some of these tools have been used for climate policy, while others have not; however, experience from dealing with other pollutants suggests their applicability to climate. Mitigation options can range from the purely technological (such as fuel switching) to the purely behavioural (such as reducing vehicle kilometres travelled) as well as innumerable combinations of both technological and behavioural options. Policies, measures and instruments are tools to trigger the implementation of these options.

13.2.1.1 Regulations and standards

Regulatory standards are the most common form of environmental regulation, and they cover a wide variety of

4 The design of most instruments assumes effective compliance and penalty provisions.

approaches. A regulatory standard specifies with a certain degree of precision the action(s) that a firm or individual must undertake to achieve environmental objectives and can consist of such actions as specifying technologies or products to use or not use and/or more general standards of performance as well as proclaiming dictates on acceptable and unacceptable behaviour. Two broad classes of regulatory standards are technology and performance standards. Technology standards mandate specific pollution abatement technologies or production methods, while performance standards mandate specific environmental outcomes per unit of product. In this context, where a technology standard might mandate specific CO_2 capture and storage methods on a power plant, a performance standard would limit emissions to a certain number of grams of CO_2 per kilowatt-hour of electricity generated. A product standard would, for example, be the requirement that refrigerators operate minimally at a specified level of efficiency, while a technology-forcing standard would involve setting the refrigerator efficiency requirement slightly beyond present-day technological feasibility but announcing that the efficiency requirement will not go into effect until a number of years following the announcement.

The primary advantage of a regulatory standard is that it may be tailored to an industry or firm, taking into account the specific circumstances of that industry or firm. There is also a more direct connection between the regulatory requirement and the environmental outcome, which can provide some degree of certainty.

Technology standards involve the regulator stipulating the specific technology or equipment that the polluter must use. Technology standards are best used when there are few options open to the polluter for controlling emissions; in this case, the regulator is able to specify the technological steps that a firm should take to control pollution. The information requirements for technology standards are high: the regulator must have good and reliable information on the abatement costs and options open to each firm. Losses in cost effectiveness arise when regulators are less well informed; technology standards may then be applied uniformly to a variety of firms, rather than tailoring the standard to the actual circumstance of the firm. This raises costs without improving environmental effectiveness and is one of the main drawbacks to regulatory standards.

Performance standards can reduce these potential problems with technology standards by providing more flexibility (IPCC, 2001). Costs can generally be lower whenever a firm is given some discretion in how it meets an environmental target. Performance standards expand compliance options beyond a single mandated technology and may include process changes, reduction in output, changes in fuels or other inputs and alternative technologies. Despite this increased flexibility, performance standards also require well-informed and responsive regulators.

One problem with regulatory standards is that they do not provide polluters with the incentive(s) to search for better approaches to reducing pollution. Thus, they may not perform well in inducing innovation and technological change (Jaffe *et al*., 2003; Sterner, 2003). If a government mandates a certain technology, there is no economic incentive for firms to develop more effective technologies. Moreover, there may be a 'regulatory ratchet' whereby firms are discouraged from developing more effective technologies out of fear that standards will be tightened yet again (Harrington *et al*., 2004). Finally, although it may be possible to force some technological change through technology mandates, it is difficult for regulators to determine the amount of change that is possible at a reasonable economic cost. This raises the possibility of implementing either costly, overly stringent requirements or, alternatively, weak, unambitious requirements (Jaffe *et al*., 2003). Nevertheless, there are examples in the literature of technology innovations spurred by regulatory standards. For example, Wätzold (2004) reported innovative responses from pollution control vendors in Germany in response to standards for SO_2 control.

Although relatively few regulatory standards have been adopted with the sole aim of reducing GHG emissions, standards have been adopted that reduce these gases as a co-benefit. For example, there has been extensive use of standards to increase energy efficiency in over 50 nations (IPCC, 2001). Energy efficiency applications include fuel economy standards for automobiles, appliance standards, and building codes.[5] These types of policies are discussed in more detail in Chapters 5 and 6 of this report. Standards to reduce methane and other emissions from solid waste landfills have been adopted in Europe, the USA and other countries (see Chapter 10) and are often driven by multiple factors, including the reduction of volatile organic compound (VOC) emissions, improved safety by reducing the potential for explosions and reduced odours for local communities (Hershkowitz, 1998).

There are a number of documented situations in which regulatory standards have worked well (see Freeman and Kolstad, 2006; Sterner, 2003). Sterner (2003) reports several cases of such situations, including those in which firms are not responsive to price signals (e.g. in non-competitive settings or with state enterprises) and where monitoring emissions is difficult but tracking the installation of technology is easy. In situations where there is imperfect monitoring and homogeneous abatement costs between firms, Montero (2005) finds that standards may lead to lower emissions and may be economically more efficient than market-based instruments. Based on an analysis of the German SO_2 abatement programme, Wätzold (2004) concludes that a technology standard may be acceptable

5 For example, the Green Building Council in the United States of America.

Box 13.3 China mandates energy efficiency standard in urban construction

Approximately 2 billion m^2 of floor space is being built annually in China, or one half of the world's total. Based on the growing pace of its needs, China will see another 20–30 billion m^2 of floor space built between the present and 2020. Buildings consume more than one third of all final energy in China, including biomass fuels (IEA, 2006). China's recognition of the need for energy efficiency in the building sector started as early as the 1980s but was impeded due to the lack of feasible technology and funding. Boosted by a nationwide real estate boom, huge investment has flowed into the building construction sector in recent years.

On 1 January, 2006, China introduced a new building construction statute that includes clauses on a mandatory energy efficiency standard for buildings. The Designing Standard for Energy Conservation in Civil Building requires construction contractors to use energy efficient building materials and to adopt energy-saving technology in heating, air conditioning, ventilation and lighting systems in civil buildings. Energy efficiency in building construction has also been written into China's 11th Five-Year National Development Programme (2006–2010), which aims for a 50% reduction in energy use (compared with the current level) and a 65% decrease for municipalities such as Beijing, Shanghai, Tianjin and Chongqing as well as other major cities in the northern parts of the country. Whether future buildings will be able to comply with the requirements in the new statute will be a significant factor in determining whether the country will be able to realize the ambitious energy conservation target of a 20% reduction in energy per gross domestic product (GDP) intensity during the 11th Five-Year Plan of 2005–2010.

when only one technology exists to achieve an environmental result and, therefore, firms do not face differential abatement costs. Finally, standards may be desirable where there are informational barriers that prevent firms or individuals from responding solely to price signals. This may be particularly relevant for energy efficiency standards for household appliances and other similar applications (OECD, 2003d). Chapter 6 provides additional information on this subject.

A growing body of literature is focusing on whether regulatory standards or market-based instruments are preferable for developing countries. One common view is that technology standards may be more appropriate for building the initial capacity for emissions reduction because economic incentive programmes require more specific and greater institutional capacity, have more stringent monitoring requirements and may require fully developed market economies to be effective (IPCC, 2001; Bell and Russell, 2002). Willems and Baumert (2003) support this approach but also note that technology approaches, policies and measures may have greater applicability to the general capacity needs of developing countries interested in pursuing sustainable development strategies (See Box 13.3). Russell and Vaughan (2003) suggest that a transitional strategy is the appropriate approach for developing countries, whereby technology standards are introduced first, followed by performance standards and finally by experimentation with market-based instruments. An alternative view is that, in some cases, a performance standard at the facility level and an overall emissions cap could provide a more a more effective structure (Ellerman, 2002; Kruger *et al*., 2003). This type of approach could also facilitate a transition to a tradable permits programme as the institutions and economies develop over time.

13.2.1.2 Taxes and charges

An emission tax on GHG emissions requires individual emitters to pay a fee, charge or tax[6] for every tonne of GHG released into the atmosphere.[7] An emitter must pay this per-unit tax or fee regardless of how much emission reduction is being undertaken.[8] Each emitter weighs the cost of emissions control against the cost of emitting and paying the tax; the end result is that polluters undertake to implement those emission reductions that are cheaper than paying the tax, but they do not implement those that are more expensive, (IPCC, 1996, Section 11.5.1; IPCC, 2001, Section 6.2.2.2; Kolstad, 2000). Since every emitter faces a uniform tax on emissions per tonne of GHG (if energy, equipment and product markets are perfectly competitive), emitters will undertake the least expensive reductions throughout the economy, thereby equalizing the marginal cost of abatement (a condition for cost-effectiveness). Taxes and charges are commonly levelled on commodities that are closely related to emissions, such as energy or road use.

An emissions tax provides some assurance in terms of the marginal cost of pollution control, but it does not ensure a particular level of emissions. Therefore, it may be necessary to

6 No distinction is made here among the terms taxes, fees or charges. In actuality, the revenue from taxes may go into the general government coffers, whereas the revenue from fees or charges may be earmarked for specific purposes.

7 Because GHGs have different effects on atmospheric warming per unit of emissions, the use of carbon dioxide equivalents (CO_2-eq) is one way of measuring relative impact.

8 An alternative is the idea of threshold taxes, where the tax per unit of emissions is only assessed on emissions greater than a set threshold (Pezzey 2003). In other words, infra-marginal emissions would be tax-exempt. This type of tax would generate less revenue but could be more politically acceptable.

adjust the tax level to meet an internationally agreed emissions commitment (depending on the structure of the international agreement). Over time, an emissions tax needs to be adjusted for changes in external circumstances, such as inflation, technological progress and new emissions sources (Tietenberg, 2000). Fixed emissions charges in the transition economies of Eastern Europe, for example, have been significantly eroded by the high inflation of the past decade (Bluffstone and Larson, 1997). Innovation and invention generally have the opposite effect by reducing the cost of emissions reductions and increasing the level of reductions implemented. If the tax is intended to achieve a given overall emissions limit, the tax rate will need to be increased to offset the impact of new sources (Tietenberg, 2000).

Most environmentally related taxes with implications for GHG emissions in OECD countries are levied on energy products (150 taxes) and on motor vehicles (125 taxes), rather than on CO_2 emission directly. There is also a significant number of waste-related taxes in OECD countries (about 50 taxes in all), levied either on particular products that can cause particular problems for waste management (about 35 taxes) or on various forms of final waste disposal, including those on incineration and/or land-filling (15 taxes in all). A very significant share of all the revenues from environmentally related taxes originates from taxes on motor fuels. Such taxes were introduced in all member countries many decades ago – primarily as a means to raise revenue. Irregardless of the underlying reasoning for their implementation, however, they do impact on the prices (potential) car users are confronted with and thus have important environmental impacts.

However, there is some experience with the direct taxation of CO_2 emissions. The Nordic Council of Ministers (2002) notes that CO_2 emissions in Denmark decreased by 6% during the period 1988–1997 while the economy grew by 20%, but that they also decreased by 5% in a single year – between 1996 and 1997 – when the tax rate was raised. Bruvoll and Larsen (2004) analysed the specific effect of carbon taxes in Norway. Although total emissions did increase, these researchers found a significant reduction in emissions per unit of GDP over the period due to reduced energy intensity, changes in the energy mix and reduced process emissions. The overall effect of the carbon tax was, however, modest, which may be explained by the extensive tax exemptions and relatively inelastic demand in those sectors in which the tax was actually implemented. Cambridge Econometrics (2005) analysed the impacts of the Climate Change Levy in the UK and found that total CO_2 emissions were reduced by 3.1 MtC – or 2.0% – in 2002 and by 3.6 MtC in 2003 compared to the reference case. The reduction is estimated to grow to 3.7 MtC – or 2.3% – in 2010.

To implement a domestic emissions tax, governments must consider a number of issues, such as the level at which the tax should be set, particularly in the case of pre-existing taxes (e.g. taxes which already exist on energy), or other potential distortions (e.g. subsidies to certain industries or fuels). Consideration must also be given to how the tax is used, with such options as whether it goes directly into general government coffers, is used to offset other taxes (i.e. the double-dividend effect), is transferred across national boundaries to an international body, is earmarked for specific abatement projects, such as renewable energy, or is allocated to those most adversely impacted by either the costs of emission reduction or damage from climate change. Another important issue is the point at which the tax is should be levied. A tax on gasoline may be levied at the pump and collected directly from consumers or it may be levied on wholesale gasoline production and collected from oil companies. In either case, the final consumer ultimately pays most of this cost, but the administrative and monitoring costs may differ dramatically in the two cases.

Emission taxes do well in both cost effectiveness and environmental effectiveness. The real obstacles facing the use of emission taxes and charges are distributional and, in some countries, institutional. At the best of times, new taxes are not politically popular. Furthermore, emissions or energy taxes often fall disproportionately on lower income classes, thereby creating negative distributional consequences. In developing countries, institutions may be insufficiently developed for the collection of emission fees from a wide variety of dispersed sources. In many countries, state enterprises play a significant role; such public or quasi-private entities may not respond adequately to the incentive effects of a tax or charge.

13.2.1.3 Tradable permits

A steadily increasing amount of research is focusing on tradable permits in terms of, among others, efficiency and equity issues associated with the distribution of permits, implications of economy-wide versus sectoral programmes, mechanisms for handling price uncertainties, different forms of targets and compliance and enforcement issues.

Tradable permit systems can be designed to cover either emissions from a few sectors of the economy or those from virtually the entire economy.[9] A number of analyses have found that economy-wide approaches are superior to sectoral coverage because they equalize marginal costs across the entire economy. Using a variety of models, Pizer *et al*. (2006) report that in the USA significant cost savings are linked to an economy-wide programme when compared to a sectoral programme coupled with non-market-based policies.[10] Researchers have found similar results for the European Union

9 Thus far, emissions trading programmes, such as those for SO_2 and NO_x in the USA and that of the EU Emis-sions Trading System (EU ETS) for CO_2 have only covered certain sectors. In the case of the EU ETS, Chris-tiansen and Wettestad (2003) write that the EU restricted the sectors involved to ease implementation during the first phase of the programme.

Box 13.4 The EU Emission Trading System

The EU Emissions Trading System (EU ETS) is the world's largest tradable permits programme. The programme was initiated on January 1, 2005, and it applies to approximately 11,500 installations across the EU's 25 Member States. The system covers about 45% of the EU's total CO_2 emissions and includes facilities from the electric power sector and other major industrial sectors.

The first phase of the EU ETS runs from 2005 until 2007. The second phase will begin in 2008 and continue through to 2012, coinciding with the 5-year Kyoto compliance period. Member States develop National Allocation Plans, which describe in detail how allowances will be distributed to different sectors and installations. During the first phase, Member States may auction off up to 5% of their allowances; during the second phase, up to 10% of allowances may be auctioned off.

Market development and prices: A number of factors affect allowance prices in the EU ETS, including the overall size of the allocation, relative fuel prices, weather and the availability of certified emission reductions (CERs) from the Clean Development Mechanism (CDM) (Christiansen *et al*., 2005). The EU ETS experienced significant price volatility during its start-up period, and for a brief period in April 2006 prices rose to nearly 30 per tonne; however, prices subsequently dropped dramatically when the first plant-level emissions data from Member States were released. The sharp decline in prices focused attention on the size of the initial Phase I allocation. Analysts have concluded that this initial allocation was a small reduction from business as usual emissions (Grubb *et al*., 2005; Betz *et al*., 2004).

Consistency in national allocation plans: Several studies have documented differences in the allocation plans and methodologies of Member States (Betz *et al*., 2004; Zetterberg *et al*. 2004; Baron and Philibert, 2005; DEHSt, 2005). Researchers have looked at the impact on innovation and investment incentives of different aspects of allocation rules (Matthes *et al*., 2005; Schleich and Betz, 2005) and have found that these rules can affect technology choices and investment decisions. Ahman *et al*. (2006), Neuhoff *et al*. (2006) and Betz *et al*., (2004) find that when Member States' policies require the confiscation of allowances following the closure of facilities, this creates a subsidy for continued operation of older facilities and a disincentive to build new facilities. They further find that different formulas for new entrants can impact on the market.

Implications of free allocation on electricity prices: Sijm *et al*. (2006) report that a significant percentage of the value of allowances allocated to the power sector was passed on to consumers in the price of electricity and that this pass-through of costs could result in substantially increased profits by some companies. The authors suggest that auctioning a larger share of allowances could address these distributional issues. In a report for the UK government, IPA Energy Consulting found a similar cost pass-through for the UK and other EU Member States (IPA Energy Consulting, 2005).

and the EU ETS. (Babiker *et al*., 2003; Betz *et al*., 2004; Klepper and Peterson, 2004; Bohringer and Löschel, 2005).

Not only the coverage of sectors may vary in a tradable permits programme, but also the point of obligation. The responsibility for holding permits may be assigned directly to emitters, such as energy-using industrial facilities (downstream), to producers or processors of fuels (upstream) or to some combination of the two (a 'hybrid system').[11] The upstream system would require permits to be held at the level of fossil fuel wholesalers and importers (Cramton and Kerr, 2002).[12]

There are two basic options for the initial distribution of permits: (1) free distribution of permits to existing polluters or (2) auctions. Cramton and Kerr (2002) describe a number of equity benefits of auctions, including providing a source of revenue that could potentially address inequities brought about by a carbon policy, creating equal opportunity for new entrants and avoiding the potential for "windfall profits" that might accrue to emissions sources if allowances are allocated at no charge.[13] (See Box 13.4 for a discussion of this issue).

Goulder *et al*. (1999) and Dinan and Rogers (2002) find that recycling revenues from auctioned allowances can have economy-wide efficiency benefits if they are used to reduce certain types of taxes. Dinan and Rogers (2002) and Parry (2004) argue that free allocation of tradable permits may be regressive because this type of allowance distribution leads to income

10 However, they also find that the exclusion of certain sectors, such as residential and commercial direct use of fossil fuels, does not noticeably affect the cost of an otherwise economy-wide tradable permit system covering electricity production, industry and transportation.
11 See IPCC (2001b), Baron and Bygrave (2002), UNEP/UNCTAD (2002), and Baron and Philibert (2005) for a discussion of the advantages and disadvantages of these different approaches.
12 As the discussion below notes, the point of obligation is not necessarily the point at which all permits need be allocated.
13 A hybrid of free allocation and auctioning or emissions taxes is also possible (Pezzey 2003). Bovenburg and Goulder (2001) and Burtraw *et al*. (2002) find that allocating only a small portion of permits at no cost while auctioning the remainder can compensate industry for losses due to a carbon policy.

transfers towards higher income groups (i.e. shareholders) at the expense of households. In contrast, these authors find that government revenues from auctions may be used to address equity issues through reductions in taxes or other distributions to low-income households. Ahman *et al*. (2006) argue that a gradual transition from free allocation to auctioning might be a politically feasible manner to develop a fairer distribution of allowances.

To date, most emissions trading programmes have distributed emissions allowances almost entirely through free allocations.[14] Experience with the US SO_2 programme shows that the no-cost allocation of allowances was critical for gaining political acceptance for the emissions trading concept (Ellerman, 2005). Christiansen and Wettestad (2003) and Markussen and Svendsen (2005) discuss how interest group pressures led to a largely free allocation of allowances in the EU ETS. In a broader sense, the rationale for a policy allowing some free allocation of allowances based on historic emissions is based on the desire to compensate incumbent installations that are affected by the regulation (Tietenberg, 2003; Harrison and Radov, 2002, Ahman *et al*. 2006).

The number of publications exploring the efficiency, equity and competitiveness implications of allowance allocation approaches is continuing to grow. For example, Burtraw *et al*. (2001b) and Fischer (2001) found that periodic updates of allocations on the basis of production are economically inefficient. In an analysis of a potential emissions trading programme in Alberta, Canada, Haites (2003b) found that this type of periodic updating of allocations based on each source's output may reduce the decline in production for some sectors that may arise from an emissions cap but that it may also reduce profits and raise overall costs when compared to a fixed allocation. Demailly and Quirion (2006) find that under certain assumptions, an output-based allocation in the European cement industry would reduce leakage with limited impacts on production. See Chapter 11, Section 11.7.4 for a more extensive discussion on competitiveness issues.

A final issue associated with the distribution of allowances is whether excessive market power can distort prices. Maeda (2003) examines how the initial distribution of permits affects the potential emergence of firms with market power. Tietenberg (2006) summarizes research on market power, including studies on whether different auction designs or initial permit allocation can lead to price manipulation by dominant firms. He concludes that in practice, market power 'typically has not been a problem in emissions trading.' There has yet to be an overall assessment of market power in the EU ETS.

Several authors have compared the advantages and disadvantages of absolute targets (i.e., mass emissions limits on a sector or economy) to those of intensity targets (i.e. limits on emission per unit of GDP).[15] Ellerman and Wing (2003) and Kolstad (2006) find that intensity targets can reduce the uncertainties associated with the cost of emission reduction under uncertain economic growth levels. Pizer (2005b) finds that intensity targets may be more appropriate if the short-term objective is to slow, rather than halt, emissions growth, while Ellerman and Wing (2003) show that an intensity target may be set so stringently that it can halt or reverse growth. Dudek and Golub (2003) argue that absolute targets have more certain environmental results and lower transaction costs for emissions trading, thereby creating stronger incentives for technological change. Kuik and Mulder (2004) find that, for the EU, an intensity or relative target would avoid negative effects on competitiveness but would not reduce emissions at the lowest costs. In contrast, an absolute target combined with permit trading leads to efficient emissions reduction, but its overall macroeconomic costs may be significant. Finally, Quirion (2005) argues that, in the most plausible cases, an emissions tax and an absolute target are superior to an intensity target and that the welfare gaps between the two types of targets are very small. Overall, intensity targets are less effective than absolute targets if the goal is to achieve a certain level of emissions reduction, but they may be more effective at addressing costs when economic growth is uncertain.

Although a tradable permits approach can ensure that a certain quantity of emissions will be reduced, it does not provide any certainty of price. Price uncertainty may be addressed by a 'price cap' or 'safety valve' mechanism, which guarantees that the government will sell additional permits if the market price of allowances hits a certain price (Pizer, 2002; McKibbon and Wilcoxen; 2002, Jacoby and Ellerman; 2004).[16] The underlying reasoning is that GHGs become the focus of concern as they accumulate over an extended period in the atmosphere. There may therefore be less concern about short-term increases in CO_2 as long as the overall trajectory of CO_2 emissions is downward over an extended period (Newell and Pizer, 2003). While the safety valve mechanism shares some advantages with price-based mechanisms, such as a tax, the former may have the added political advantage of providing emitters with an additional allocation of allowances (Pizer, 2005a). A safety valve mechanism does not provide any certainty that a particular emissions level will be met, and it requires additional administrative complexity to link a domestic programme with a safety valve to a programme without a safety valve or with a different safety valve price.

14 The US SO_2 trading programme contains a small reserve auction, which was valuable for price discovery during the early years of the programme (Ellerman *et al*., 2000). Revenue from this auction was returned to the companies affected in the programme. Only four EU Member States (Denmark, 5%; Hungary, 2.5%; Ireland, 0.75%; Lithuania, 1.5%) decided to auction off parts of their ET budget in the first phase of the EU ETS scheme (Betz *et al*., 2004).

15 Intensity targets are also known as "rate-based", "dynamic," "indexed," and "relative" targets.

16 It is also possible to have a "price floor" to ensure that prices don't go below a certain level. For example, Hepburn *et al*. (2006) discuss how a coordinated auction measure for the EU ETS could be used to support a minimum price.

Experience with trading programmes in the USA has shown significant benefits can be derived from the temporal flexibility provided by banking provisions in cases where the exact timing of emission reductions is not critical to environmental effectiveness (Ellerman *et al*., 2000; Stavins, 2003). Allowance banking can create a cushion that will prevent price spikes and can hedge uncertainty in allowance prices (Jacoby and Ellerman, 2004).[17] A banking provision allows the arbitrage between actual marginal abatement costs in one phase of a programme and the expected abatement costs in a future phase of a programme. The temporal flexibility of banking is particularly useful for companies facing large capital expenditures because it provides some flexibility in the timing of those expenditures (Tietenberg, 2003). In some emission markets in the USA, banking has been restricted where there was concern about short-term increases in emissions (Tietenberg, 2006). Banking was also restricted between Phase I and Phase 2 in the EU ETS to avoid a large bank that would make it more difficult to meet Kyoto targets.

Several critical elements of an effective enforcement regime for emissions trading have been described in the literature. First, if the goal is strict adherence to the emission limits implied by the number of permits, then excess emissions penalties should be set at levels substantially higher than the prevailing permit price in order to create the appropriate incentives for compliance (Swift, 2001; Stranland *et al*., 2002).[18] A second component of an enforcement regime is reasonably accurate emissions monitoring (Stranland *et al*., 2002; Stavins, 2003). San Martin (2003) and Montero (2005) report that incomplete monitoring can undermine the efficiency of trading programmes. Tietenberg (2003) and Kruger *et al*. (2000) emphasize that public access to emissions and trading data provides an additional incentive for compliance.

Finally, there have been several experiments with tradable permits for conventional pollution control in developing countries and economies in transition (Bygrave, 2004; US EPA, 2004). For example, Montero *et al*. (2002) evaluate an experiment with tradable permits for total suspended particulates (TSP) in Santiago, Chile and find that permit markets are underdeveloped due to high transaction costs, uncertainty and poor enforcement. However, they also find an improved documentation of historic emissions inventories and an increased flexibility to address changing market conditions. S. Gupta (2003b) and Wang *et al*. (2004) suggest strengthening the monitoring and enforcement capacity that would be required to implement conventional pollution trading programmes in India and China, respectively. Several authors have concluded that tradable permit programmes may be less appropriate for developing countries due to their lack of appropriate market or enforcement institutions. (Blackman and Harrington, 2000, Bell and Russell, 2002)

13.2.1.4 Voluntary agreements

Voluntary agreements are agreements between a government authority and one or more private parties to achieve environmental objectives or to improve environmental performance beyond compliance to regulated obligations. Voluntary agreements are playing an increasingly important role in many countries as a means to achieve environmental and social objectives. They tend to be popular with those directly affected and can be used when other instruments face strong political opposition (Thalmann and Baranzini, 2005). Box 13.5 provides examples of VAs. See Chapter 7, Section 7.9.2 for additional information.

Voluntary agreements can take on many forms with varying levels of stringency. While all VAs are 'voluntary' insofar as firms are not compelled to join, some may involve incentives (rewards or penalties) for participation. Firms may agree to direct emissions reductions or to indirect reductions through changes in product design (see Chapter 6, Section 6.8.2.2.). Agreements may be stand-alone, but they are often used in conjunction with other policy instruments. Voluntary agreements are also a subset of a larger set of 'voluntary approaches' in which industry may first negotiate standards of behaviour with other firms or private groups and then allow third parties to monitor compliance. This larger set also includes unilateral voluntary actions by industry. See Section 13.4, Box 13.5, and Chapter 7, Section 7.9.2 for more information on voluntary actions.

The benefits of VAs for individual companies and for society may be significant. Firms may enjoy lower legal costs, enhance their reputation and improve their relationships with society on a whole and shareholders in particular. Societies gain to the extent that firms translate goals into concrete business practices and persuade other firms to follow their example. The negotiations involved to develop VAs raise awareness of climate change issues and potential mitigative actions within industry (Kågeström *et al*., 2000), establish a dialogue between industry and government and help shift industries towards best practices.

Evaluating the effectiveness of VAs is not easy. The standard approach is first to measure the environmental performance of a group of firms participating in a VA and then to compare the performance to that of a typical non-participating firm or firms. One problem with this approach is selection bias: it is often the best-performing firms that enter into a VA. A second and related problem is the counterfactual: it is difficult to know what a firm might have done had they not entered into the VA. Very few studies have attempted to evaluate VAs by taking into account both of these issues. Studies which do not take these factors into account can produce an overly optimistic view of the performance of a VA.

17 Price uncertainty may also be addressed by "borrowing" of allowances, i.e. using allowance allocations from future years.
18 The addition of a "make good" provision – that is, the requirement stating that allowances from a subsequent compliance year or period are surrendered for any excess emissions – is a further design element used to ensure that an absolute emissions target is met (Betz and MacGill, 2005).

The environmental effectiveness of VAs is the subject of much discussion. Some governments – as well as industry – believe that VAs are effective in reducing GHG emissions (IAI, 2002; OECD, 2003c). Rietbergen *et al*. (2002) investigated whether the voluntary agreements in The Netherlands have resulted in improvements in energy efficiency beyond what would have occurred in the absence of such agreements. They estimate that, on average, between 25% and 50% of the energy savings in the Dutch manufacturing industry can be attributed to the policy mix of the agreements and supporting measures.

Others are more sceptical about the efficacy of VAs in reducing emissions. Independent assessments of VAs – while acknowledging that investments in cleaner technologies have resulted in absolute emission improvements – indicate that there is little improvement over business-as-usual (BAU) scenarios, as these investments would have probably happened anyway (Harrison, 1999; King and Lenox, 2000; Rietbergen and Blok, 2000; OECD, 2003e; Rivera and deLeon, 2004). The economic efficiency of VAs can also be low, as they seldom incorporate mechanisms to equalize marginal abatement costs between different emitters (Braathen, 2005).

There are a limited, although increasing, number of comprehensive reviews of the effectiveness of VAs, but any comparison of these reviews and assessments is difficult because of the different metrics and evaluative criteria employed (Price, 2005). In general, studies of the design and efficacy of VAs assess only a single programme (e.g. Arora and Cason, 1996; Khanna and Damon, 1999; King and Lenox, 2000; Welch *et al*., 2000; Rivera, 2002; Croci, 2005). Based on her evaluation of the French experience, Chidiak (2002) suggests that the reductions in GHG emissions cannot necessarily be seen as a direct consequence of the commitments within the agreements and argues that, in actual fact, these improvements have been triggered largely as a result of other environmental regulations and cost reduction efforts. Johannsen (2002) and Helby (2002) present similar results for programmes in Denmark and Sweden, respectively. They note that reductions in specific emissions correspond with industry's BAU behaviour, thereby suggesting that the stated objectives in the agreements were not sufficiently ambitious. In particular, Helby concludes that EKO-Energi, which sought to highlight a new level of best practice and thus pose a challenge to other firms, was 'at best a very modest success,' resulting in a small overall direct effect on total industrial energy consumption. Interestingly, Chidiak also finds that the agreements did not foster intra-industry networking and information exchange on energy management and suggests that their failure to achieve more ambitious goals is a result of the lack of a well-articulated policy-mix. Other analyses indicate that VAs work best as part of a policy package, rather than as a stand-alone instrument (Krarup and Ramesohl, 2002; Torvanger and Skodvin, 2002). OECD (2003e) and Braathen (2005) note that many of the current VAs would perform better if there were a real threat of other instruments being used if targets are not met.

The US Government Accountability Office (2006), in its review of the US Climate Vision and Leaders Programmes, which are supported by the Environmental Protection Agency (EPA) and Department of Energy (DOE), finds that emission reduction goals were set for only 38 of 74 participants, that some goals are intensity-based and others emission-based and that programmes vary in terms of how they are measured, the time periods covered, the requirements for reporting and the means of tracking progress. Brouhle *et al*. (2005) note that the difficulties in evaluating US programmes is associated to the many different programmes and their goals that need be sorted, the availability of adequate data and the measuring of achievement relative to a baseline. Jaccard *et al*. (2006) review various Canadian voluntary programmes that have been in existence for 15 years and report that during that period emissions have grown by 25%.

Darnall and Carmin (2003) review 61 governmental, industry and third-party general environmental agreements, mainly in the USA (see also Lyon and Maxwell, 2000). Overall, their results demonstrate that the voluntary programmes had low programme rigour in that they had limited levels of administrative, environmental and performance requirements. For example, two thirds did not require participants to create environmental targets and to demonstrate that the targets were met. Similarly, almost 50% of the programmes had no monitoring requirements. Compared to government programmes, industry programmes had stronger administrative requirements and third party programmes had yet even slightly stronger requirements. According to Hanks (2002) and OECD (2003e), the best VAs include: a clear goal and baseline scenario; third party participation in the design of the agreement; a description of the parties and their obligations; a defined relationship within the legal and regulatory framework; formal provisions for monitoring, reporting and independent verification of results at the plant level; a clear statement of the responsibilities expected to be self-financed by industry; commitments in terms of individual companies, rather than as sectoral commitments; references to sanctions or incentives in the case of non-compliance.

It must be acknowledged that VAs fit into the cultural traditions of some countries better than others. Japan, for example, has a history of co-operation between government and industry that facilitates the operation of "voluntary" programmes. Some examples of VAs in various countries are provided in Box 13.5.

13.2.1.5 Subsidies and incentives

Direct and indirect subsidies can be important environmental policy instruments, but they have strong market implications and may increase or decrease emissions, depending on their nature. Subsidies aimed at reducing emissions can take different forms, ranging from support for Research and Development

Box 13.5 Examples of national voluntary agreements

- **The Netherlands Voluntary Agreement on Energy Efficiency:** A series of legally binding long-term agreements based on annual improvement targets and benchmarking covenants between 30 industrial sectors and the government with the objective to improve energy efficiency.
- **Australia "Greenhouse Challenge Plus" programme:** An agreement between the government and an enterprise/industry association to reduce GHG emissions, accelerate the uptake of energy efficiency, integrate GHG issues into business decision making and provide consistent reporting.[19] See http://www.greenhouse.gov.au/challenge.
- European Automobile Agreement: An agreement between the European Commission and European, Korean and Japanese car manufacturing associations to reduce average emissions from new cars to 140 gCO_2/km by 2008–2009. See http://ec.europa.eu/environment/CO_2/CO_2_agreements.htm.
- **Canadian Automobile Agreement:** An agreement between the Canadian government and representatives of the domestic automobile industry to a reduce emissions from cars and light-duty trucks by 5.3 $MtCO_2$-eq by 2010. The agreement also contains provisions relating to research and development and interim reduction goals.
- **Climate Leaders:** An agreement between US companies and the government to develop GHG inventories, set corporate emission reduction targets and report emissions annually to the US EPA. See: http://www.epa.gov/climateleaders/.
- **Keidaren Voluntary Action Plan:** An agreement between the Japanese government and 34 industrial and energy-converting sectors to reduce GHG emissions. A third party evaluation committee reviews the results annually and makes recommendations for adjustments.[20] See http://www.keidanren.or.jp

(R&D), investment tax credit, and price supports (such as feed-in tariffs for renewable electricity).[21] Subsidies that increase emissions typically involve support for fossil fuel production and consumption. They tend to expand the subsidized industry, relative to the non-subsidy case. If the subsidized industry is a source of GHG emissions, subsidies may result in higher emissions. Subsidies to the fossil fuel sector result in over-use of these fuels with resulting higher emissions; subsidies to agriculture can result in the expansion of agriculture into marginal lands and corresponding increases in emissions. Conversely, incentives to encourage the diffusion of new technologies, such as those for renewables or nuclear power, may promote emissions reductions.

One of the significant advantages of subsidies is that they have politically positive distributional consequences. The costs of subsidies are often spread broadly through an economy, whereas the benefits are more concentrated. This means that subsidies may be easier to implement politically than many other forms of regulatory instruments. Subsidies do tend to take on a life of their own, which makes it difficult to eliminate or reduce them, should that be desired.

The International Energy Agency (IEA) estimates that in 2001 energy subsidies in OECD countries alone were approximately 20–80 billion US$ (IEA, 2001). The level of subsidies in developing and transition economy countries is generally considered to be much higher. One example is low domestic energy prices that are intended to benefit the poor, but which often benefit high users of energy. The result is increased consumption and delayed investments in energy-efficient technologies. In India, kerosene and liquefied petroleum gas (LPG) subsidies are generally intended to shift consumption from biomass to modern fuels, reduce deforestation and improve indoor air quality, particularly in poor rural areas. In reality, these subsidies are largely used by higher expenditure groups in urban areas, thus having little effect on the use of biomass. Nevertheless, removal of subsidies would need to be done cautiously, in the absence of substitutes, as some rural households use kerosene for lighting (Gangopadhyay *et al*., 2005).

OECD countries are slowly reducing their subsidies to energy production or fuel (such as coal) or changing the structure of their support to reduce the negative effects on trade, the economy and the environment. Coal subsidies in OECD countries fell by 55% between 1991 and 2000 (IEA, 2001).[22] (See Chapter 7 for additional information.)[23] About 460 billion US$ is spent on agricultural subsidies, excluding water and fisheries (Humphreys *et al*., 2003), with OECD

19 As of 1 July 2006, participation in the programme is a requirement for Australian companies receiving fuel tax credits of more than 3 million US$.
20 This programme is a cross between a mandatory and voluntary programme; see Saito (2001), Yamaguchi (2003) and Tanikawa (2004) for additional information. The special relationship between the government and industry as well as unique societal norms make this voluntary initiative unique. In the context of Japan there is de facto enforcement.
21 One way of promoting the use of renewable sources of electricity is for the government to require electric power producers to purchase such electricity at favourable prices. The US Public Utility Regulatory Policy Act of 1978 required electric utilities to buy renewable energy at "avoided cost". In Europe, specific prices have been set at which utilities must purchase renewable electricity – these are referred to as "feed-in tariffs." These tariffs have been effective at promoting the development of renewable sources of electricity (Ackermann *et al*., 2001; Menanteau *et al*., 2003).
22 Calculated using producer subsidy equivalents.
23 It should be noted that a comprehensive analysis of subsidies requires the net effect of subsidies and taxes, including their point of allocation, to be considered.

countries accounting for about 318 billion US$ or 1.2% of the GDP. These subsidies result in the expansion of this sector with associated GHG implications (OECD, 2001, 2002).

Many countries provide financial incentives, such as tax credits for energy-efficient equipment and price supports for renewable energy, to stimulate the diffusion of technologies. In the USA, for example, the Energy Policy Act of 2005 contains an array of financial incentives for various advanced technologies; these financial incentives have been estimated at 11.4 billion US$ over a 10-year period.

One of the most effective incentives for fostering GHG reductions are the price supports associated with the production of renewable electricity, which tend to be set at attractive levels. These price supports have resulted in the significant expansion of the renewable energy sector in OECD countries due to the requirement that electric power producers purchase such electricity at favourable prices. The US Public Utility Regulatory Policy Act of 1978 requires electric utilities to buy renewable energy at "avoided cost". In Europe, specific prices have been set at which utilities must purchase renewable electricity – these are referred to as 'feed-in tariffs'. These tariffs have been effective at promoting the development of renewable sources of electricity (Ackermann *et al*., 2001; Menanteau *et al*., 2003). As long as renewables remain a relatively small portion of overall electricity production, consumers see only a small increase in their electricity rates. Incentives therefore have attractive properties in terms of environmental effectiveness, distributional implications and institutional feasibility. The main problem with them is cost-effectiveness: They are costly instruments, particularly in the long-run as interests and industries grow to expect the continuation of subsidy programmes. See Chapter 4.5 for a more extensive discussion.

13.2.1.6 Research and Development[24]

The role of R&D in changing the trajectory of energy economy is unquestionable – new technologies have played a large role in the evolution of the energy sector over the last century. Moreover, the rate at which low emission technologies will improve during the next 20–30 years will be an important determinant of whether low emission paths can be achieved in the long term.

Policy uncertainties, however, often hinder investment in R&D and the dissemination of new technology, although different types of polices may be needed to address different types of investment. Hamilton (2005) notes that investors prefer a policy environment which is 'loud, long and legal'. A number of authors note that long-term policy targets or clear foresight on carbon taxes can overcome social inertia and reduce uncertainty for investors in R&D (Blyth and Yang, 2006; Edenhofer *et al*., 2006; Reedman, Graham and Coombes, 2006).

Nearly 600 billion US$ was expended worldwide on R&D in all sectors in 2000, with approximately 85% of that amount being spent in only seven countries.[25] Over the last 20 years, the percentage of government-funded R&D has generally declined, while industry-funded R&D has increased in these countries. In a historic context, R&D expenditures as a percentage of GDP have gone up and down in cycles as government priorities have changed over the last 50 years, although in some instances comparisons over time are difficult (US-NSF, 2003; OECD, 2005a; US-GAO, 2005).

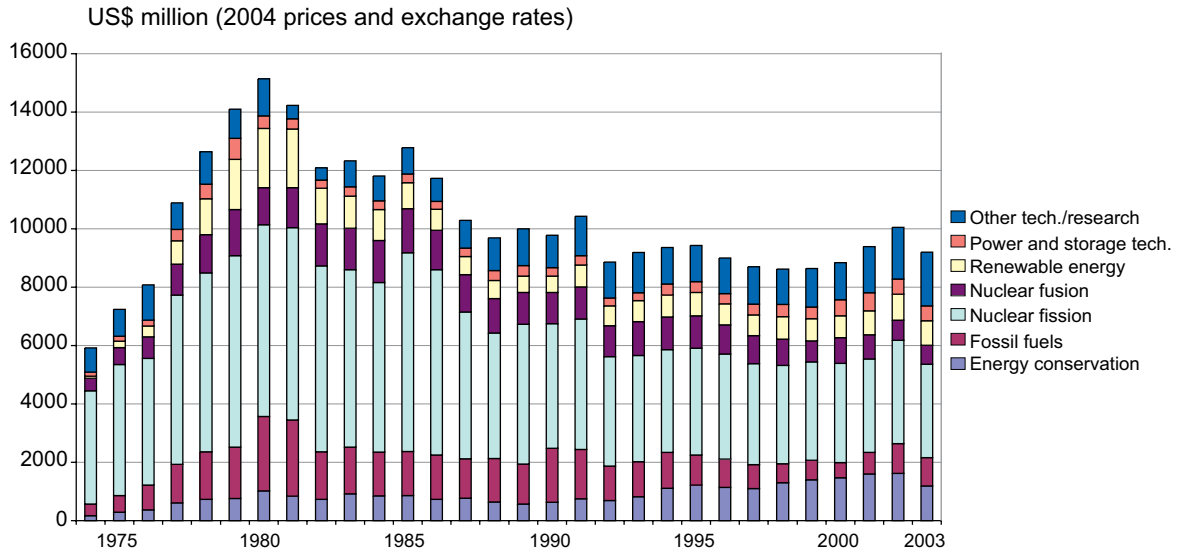
Total public funding for energy technologies in IEA countries during the period 1987–2002 was 291 billion US$, with 50% of this allocated to nuclear fission and fusion, 12.3% to fossil fuels and 7.7% to renewable energy technologies (IEA, 2004; see Figure 13.1).[26] Funding has dropped after the initial interest created through the oil shock in the 1970s and has stayed constant, even after the UNFCCC was ratified. Nemet and Kammen (2006) suggest that for the USA a change in direction is warranted and that a five- to tenfold increase in public funding is feasible.

The USA and Japan, the two largest investors in energy R&D, spent on average of 3.38 and 2.45 billion US$, respectively, between 1975 and 1999. However, such figures mask important underlying trends. For example, a large percentage of the funding designated for energy R&D has gone into nuclear power – nearly 75% in the case of Japan (Sagar and van der Zwaan 2006). The support of the US government for R&D declined by 1 billion US$ from 1994 to 2003, with reductions implemented in nearly all energy technologies, while R&D investments in other areas grew by 6% per year. Between the 1980s and 2003, private sector energy R&D declined from nearly 50% of that of government funding to about 25% (Nemet and Kammen, 2006).

Many countries pursue technological (R&D) advancements as a national policy for a variety of different reasons: for example, to foster the development of innovative technologies or to assist domestic industries in being competitive. Countries also chose to co-operate with each other in order to share costs, spread risks, avoid duplication, access facilities, enhance domestic capabilities, support specific economic and political objectives, harmonize standards, accelerate market learning and create goodwill. Cooperation, however, may increase

24 As used in this section, the term R&D generally refers to research, development and demonstration.
25 Canada, France, Germany, Italy, Japan, the UK and the USA.
26 In year-2000 US$ and exchange rates.

13.1 (a). RD&D budgets for energy



13.1(b). RD&D budgets for renewable energy

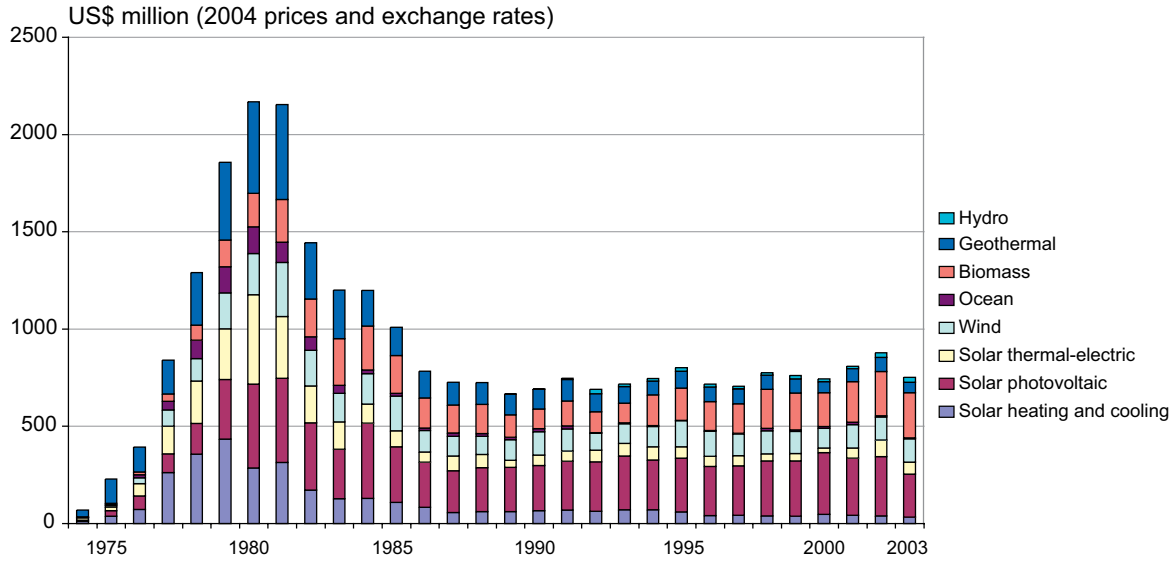


Figure 13.1: *Public funded Research and Development (R&D) expenditures for energy (A) and renewable energy technologies (B) by International Energy Agency (IEA) member countries.*

Source: IEA, 2004, 2005.

transaction costs, require extensive coordination, raise concerns over intellectual property rights and foreclose other technology pathways (Fritsche and Lukas, 2001; Sakakibara, 2001; Ekboir, 2003; Justice and Philibert, 2005). Governments use a number of tools to support R&D, such as grants, contracts, tax credits and allowances and public/private partnerships. The effect of these tools on public budgets and their effectiveness in stimulating innovation will vary as a function of how they are structured and targeted. For example, in the USA, R&D tax credits to industry totalled an estimated 6.4 billion US$ in 2001; however, industries associated with high GHG emissions did not take advantage of this opportunity in that the utility industry received only 23 million US$.[27]

There are different views on the role of R&D, its links to the overall energy innovation system and processes underlying effective learning. Sagar and van der Zwaan (2006) examined the trends in major industrialized countries and report that public R&D spending does not correlate with changes in national energy intensity or carbon emissions per unit of energy

27 http://www.nsf.gov/statistics/inbrief/nsf/nst05316

consumption. For a more extensive discussion of technological learning, energy supply models and the link to R&D, see Chapter 3, Section 3.4.2 and Chapter 11, Section 11.3.3. Watanabe (1999) argues that government R&D can play a role in achieving breakthroughs in some areas, induce investments by industry in R&D and generate trans-sectoral spill over effects. Others have noted, however, that the benefits of R&D may not be realized for two to three decades, which is beyond the planning horizons of even the most forward-looking companies (Anderson and Bird, 1992) and that, for a variety of reasons, industry can only appropriate a fraction of the benefits of R&D investments (Margolis and Kammen ,1999). In the energy sector in particular, technology 'spill over' to competitors is large; as a result, firms under-invest in R&D (Azar and Dowlatabadi 1999) and face difficulties in evaluating intangible R&D outputs (Alic *et al*. 2003).[28] In addition, regulatory interventions can cap profits in the case of path-breaking research success (Foxon and Kemp, 2004; Grubb, 2004).[29] Goulder and Schneider (1999) argue that increasing R&D expenditures in carbon-free technologies could crowd out R&D in the rest of the economy and therefore reduce overall growth rates. However, Azar and Dowlatabadi (1999) counter that radical technological change will trigger more research overall and therefore increase economy-wide productivity rates.

The OECD (2005b) finds that obligations/quotas, price guarantees and tax preferences have had the most influence on innovation and patent activities in the renewable energy sector and that while public subsidies for R&D have not played a role, the overall level of investment in R&D within the economy of a country has been important. Sathaye *et al*. (2005) observe that government-funded research at government-owned facilities, private companies and universities may help identify patentable technologies and processes. They reviewed the process of allocating patent rights in four OECD countries and found that intellectual property rights (IPR) regimes have changed since the ratification of the UNFCCC, with diffusion typically taking place along a pathway of licensing or royalty payments rather than unrestricted use in the public domain. Popp (2002) also examined patent citations and found that the level of energy-saving R&D depends not only on energy prices, but also on the quality of the accumulated knowledge available to inventors. He finds evidence for diminishing returns to research inputs – both across time and within a given year – and notes that government patents filed in or after 1981 are more likely to be cited. Popp (2004) notes that when in terms of the potential for technology to help solve the climate problem, two market failures lead to underinvestment in climate-friendly R&D: environmental externalities and the public goods nature of the new knowledge. As a result, government subsidies to climate-friendly R&D projects are often proposed as part of a policy solution.

Policies that directly affect the environmental externality have a much larger impact on both atmospheric temperature and economic welfare. Fischer and Newell (2004) examine several policy options to promote renewables and indicate that research subsidies are the most expensive approach to achieve emission reductions – in the absence of higher prices. They note that the process of technological change is less important than the implementation of direct incentives to reduce emission intensity or overall energy use. A more specific example arises from the Danish experience with wind technologies. Meyer (2004) notes that despite significant support for wind energy R&D during the 1980s, wind power only boomed in Denmark when favourable feed-in tariffs were introduced, procedures for construction allowances were simplified and priority was given for green electricity. This is supported by Nemet (2005), who found that the ability to raise capital and take risks has played a much larger role in the recent expansion of the photovoltaic industry than other factors, such as learning by experience.

In summary, national programmes and international cooperation relating to R&D are essential long-term measures to stimulate technological advances. Substantial additional investments in and policies for R&D are needed, depending on the specific goals: for example, if high stabilization levels are desired (e.g. 750 ppmv CO_2-eq, which is scenario category D of Chapter 3 of this report), a technology-focused approach that defers emissions reduction to the future would be sufficient; for low stabilization goals (e.g. 450 ppmv CO_2-eq, which is category A1, or 550 ppmv CO_2-eq, which is category B), strong incentives for short-term emission reductions would be necessary in addition to technological development and deployment programmes. See Section 13.3 for a discussion of goals.

13.2.1.7 Information instruments

Information instruments – such as public disclosure requirements and awareness/education campaigns – may positively affect environmental quality by allowing consumers to make better-informed choices. When firms or consumers lack the necessary information about the environmental consequences of their actions, they may act inefficiently. While some research indicates an information provision can be an effective environmental policy instrument, we know less about its efficacy in the context of climate change. Examples of information instruments include labelling programmes for consumer products, information disclosure programmes for firms and public awareness campaigns.

Article 6 of the UNFCCC on Education, Training and Public Awareness calls on governments to promote the development

28 An assessment of private public research partnership under the Advanced Technology Programme in the USA indicates that 'Time lags, along with the difficulty inherent in retrospective evaluation of factors affecting the timing and character of innovations, make it difficult to attribute specific commercial advantages to funding awarded much earlier.' In general, companies shift funds away from basic research towards product modifications and extensions.

29 Renewable energy technologies compete in electricity wholesale markets that are frequently exposed to regulations, such as price caps, which reduce incentives for private investment in long-term R&D.

and implementation of educational and public awareness programmes, promote public access to information and public participation and promote the training of scientific, technical and managerial personnel. With decision 11/CP.8, the Conference of the Parties (COP) launched a 5-year country-driven work programme to engage stakeholders in information/education activities. The UNFCCC secretariat notes that there is a general lack of resources, limited technical skill and poor regional coordination relating to information and education campaigns (UNFCCC 2006a).

Information instruments can often be used to improve the effectiveness of other instruments. Another feature common to all information instruments that makes them unique from other environmental policies is that they do not impose penalties for environmentally harmful behaviour per se. A disclosure programme, such as the Toxics Release Inventory (TRI), requires only that firms document and report their emissions; it does not place limits on how much pollution they can emit.

Kennedy *et al*. (1994) demonstrate that environmental externalities can be at least partially corrected through information provision. However, they also point out that when other corrective instruments, such as taxes, are available, these measures are preferable to information policies. Based on a recent theoretical study, Petrtakis *et al*. (2005) reports that information provision can be more effective than tax instruments, especially when the information can be provided at low cost. Osgood (2002) provides limited empirical support in the context of weather information programmes in Mexico and California.

Evidence-to-date suggests that while disclosure mandates may be effective at changing a firm's environmental practices, other information instruments, such as advisory programmes, have less effect on consumer behaviour (Konar and Cohen, 1997). Firms whose stock price declined significantly when pollution data became publicly available reduced their emissions more than other firms in the same industry. Firms may view information policies as overly burdensome and argue that voluntarily provided information is sufficient (Sterner, 2003). Certainly, there is a cost to disclosure and labelling policies, and costs depend on the level of information required by a policy (Beierle, 2004). A firm may have to collect and disseminate information they would not otherwise have gathered, and government agencies must be able to verify that the information is accurate.

13.2.1.8 Non-climate policies

There are a number of non-climate national policies that can have an important influence on GHG emissions. These include policies focused on poverty, land use and land use change, energy supply and security; international trade, air pollution, structural reforms and population policies. Only a few types of 'non-climate policies' are touched upon in this section.

The literature available on this topic indicates that poverty reduces the resilience of vulnerable populations and makes them more at risk to the potential impacts of climate change, but it also leads communities to take measures that may increase emissions. Heemst and Bayangos (2004) note that if poverty can be reduced without raising emissions, then a strategy to reduce poverty can be seen as a way to reduce emissions as well as enhance resilience. Typical areas of synergy include small-scale renewables (Richards, 2003) and community forestry (Smith and Scherr, 2002), both of which may benefit the poor.

Land use policies (or the lack thereof), whether terrestrial (agriculture, forestry, nature), aquatic (wetlands) or urban, can lead to enhanced emissions. Verhagen *et al*. (2004) note that policies aimed at integrating climate change concerns with the specific concerns of local people may yield major synergies. For example, within the Netherlands, a major programme is currently underway to understand how spatial planning and climate change policy can be effectively linked. Regional (acid rain abatement), local and indoor air pollution policies can also have climate change co-benefits (Bakker *et al*., 2004).

The consumption of natural resources varies significantly between developed and developing countries and is ultimately one of the major drivers of global emissions. The global population and income levels affect the consumption of natural resources, particularly those of energy, food and fibre, and hence can also affect GHG emissions. Policies that increase consumption of natural resources have implications for GHG emissions.

13.2.2 Linking national policies

13.2.2.1 National policy interactions/linkages and packages

Single instruments are unlikely to be sufficient for climate change mitigation, and it is more likely that a portfolio of policies will be required (see IPCC, 2001). Examples of areas where there are potential synergies include water management strategies, farm practices, forest management strategies and residential building standards. Instruments that maximize potential synergies could become socially and economically efficient and may offer opportunities for countries to achieve sustainable development targets, even in the face of uncertainties. This is especially important given the limited financial and human resources in developing countries (Dang *et al*., 2003). Climate change considerations also provide both developing and developed countries with an opportunity to look closely at their respective development strategies from a new perspective. Fulfilling development goals through policy reforms in such areas as energy efficiency, renewable energy, sustainable land use and/or agriculture will often also generate benefits related to climate change objectives.

A key synergy is that between adaptation and mitigation policies. Climate policy options can include both mitigation and

adaptation (see Chapter 17 of IPCC (2007b) for a discussion on adaptation policies and Chapter 18 for a detailed analysis of interaction between mitigation and adaptation). Many adaptation options are consistent with pathways towards effective and long-term mitigation and, in turn, several mitigation options can facilitate planned adaptation.

In theory, a perfectly functioning market would need only one instrument (e.g. a tax) to address a single environmental problem, such as climate change. In such a situation, the application of two or more overlapping instruments could diminish economic efficiency while increasing administrative costs. In practice, however, there are market failures that may make a mix of instruments desirable. This section describes some of these cases and addresses situations in which multiple or overlapping objectives might justify a mix of policies.

Climate-related policies are seldom applied in complete isolation: in a large number of cases one or more instruments will be applied. The mere existence of an instrument mix, however, is clearly not 'proof' of its environmental effectiveness and economic efficiency. A rather obvious first requirement for applying an environmentally and economically effective instrument mix is to have a good understanding of the environmental issue to be addressed. In practice, many environmental issues can be complex. While a tax can affect the total demand for a product and the choice between different product varieties, it is less suited to address, for example, how a given product is used and when it is used. Hence, other instruments could be needed. A second requirement for designing efficient and effective policies is to have a good understanding of the links with other policy areas: not only do different environmental policies need to be co-ordinated, but co-ordination with other related policies is also necessary. A third requirement is to have a good understanding of the interactions between the different instruments in the mix.

Several authors describe situations in which a combination of policies might be desirable. Johnstone (2002) argues that the price signal from a tradable permits or tax system may not be sufficient to overcome barriers to technological development and diffusion and that additional policies may be warranted. These barriers include: (1) credit market failures that discourage lenders from providing capital to firms for high-risk investments associated with R&D and even the implementation of new technologies and (2) reduced incentives for private investment in R&D if firms can not prevent other firms from benefiting from their investments (i.e. 'spill-over' effects).[30] Fischer and Newell (2004) find that the combination of a technology policy, such as government sponsored R&D, with a tax or tradable permit instrument could help overcome this type of market imperfection.

A second market failure that may require more than one instrument is the lack of information among consumers on the environmental or economic attributes of a technology. In such a case, a price signal alone may not sufficiently spur the diffusion of these types of technologies. One solution to this type of barrier is an eco-labelling system, which can help increase the effectiveness of a price instrument by providing better information on relevant characteristics of the product (OECD, 2003b; Braathen, 2005). Sijm (2005) notes that this type of market failure may exist for households who may lack the relevant information to invest in energy efficiency measures and may not respond to a price signal. Another market failure in the residential sector may be caused by split incentives where neither the landlord nor tenant has an incentive to invest in energy efficiency measures (Sorrell and Sijm, 2003).

With the implementation of the EU ETS, particular attention has been given to the interaction between a tradable permits mechanism and other policies. Sijm (2005) and Sorrell and Sijm (2003) argue that an emissions trading scheme can co-exist with other instruments as long as these other instruments improve the efficiency of the trading mechanism by addressing market failures or contributing to some other policy objective. However, they argue that the combination of an emissions trading scheme with other instruments could also lead to "double regulation", reduced efficiency and increased costs if policies are not designed carefully. NERA (2005) and Morthorst (2001) assess the interaction of renewable energy policies with tradable permits programmes and conclude that if not designed properly, these policies can lower allowance prices but raise the overall costs of the programme.

There may be cases where a package of CO_2 mitigation policies is justified if these policies serve multiple policy objectives. Sijm (2005) gives several examples of policies and objectives that may be compatible with the EU ETS, including direct regulation that also reduces local environmental effects from other pollutants. Renewable energy policies can be used to expand energy supply, increase rural income and reduce conventional pollutants. Policies that encourage bio-fuel production and automobile fuel efficiency have also been advocated for their advantages in encouraging energy security and fuel diversity as well as GHG mitigation. In the USA, these types of energy policies have been proposed in conjunction with a tradable permits system as part of a package to address energy, security and environmental objectives (NCEP, 2004).

13.2.2.2 Criteria assessment

Any evaluation of the instruments based on the criteria discussed herein is challenging for two reasons. First, practitioners must be able to compare potential instruments based on each of the evaluative criteria. Unfortunately, in many cases it can be difficult if not impossible to rank instruments in an objective manner. For example, Fischer *et al*. (2003) conclude that it is not possible to rank environmental policy

30 For a more extensive discussion of these issues, see Jaffe *et al*., 2003.

Table 13.1: *National environmental policy instruments and evaluative criteria* [a]

Instrument	Criteria			
	Environmental effectiveness	**Cost-effectiveness**	**Meets distributional considerations**	**Institutional feasibility**
Regulations and standards	Emissions level set directly, though subject to exceptions. Depends on deferrals and compliance.	Depends on design; uniform application often leads to higher overall compliance costs.	Depends on level playing field. Small/new actors may be disadvantaged.	Depends on technical capacity; popular with regulators in countries with weakly functioning markets.
Taxes and charges	Depends on ability to set tax at a level that induces behavioural change.	Better with broad application; higher administrative costs where institutions are weak.	Regressive; can be ameliorated with revenue recycling.	Often politically unpopular; may be difficult to enforce with underdeveloped institutions.
Tradable permits	Depends on emissions cap, participation and compliance.	Decreases with limited participation and fewer sectors.	Depends on initial permit allocation. May pose difficulties for small emitters.	Requires well functioning markets and complementary institutions.
Voluntary agreements	Depends on programme design, including clear targets, a baseline scenario, third party involvement in design and review and monitoring provisions.	Depends on flexibility and extent of government incentives, rewards and penalties.	Benefits accrue only to participants.	Often politically popular; requires significant number of administrative staff.
Subsidies and other incentives	Depends on programme design; less certain than regulations/standards.	Depends on level and programme design; can be market distorting.	Benefits selected participants, possibly some that do not need it.	Popular with recipients; potential resistance from vested interests. Can be difficult to phase out.
Research and development	Depends on consistent funding; when technologies are developed and polices for diffusion. May have high benefits in the long term.	Depends on programme design and the degree of risk.	Benefits initially selected participants; potentially easy for funds to be misallocated.	Requires many separate decisions. Depends on research capacity and long-term funding.
Information policies	Depends on how consumers use the information; most effective in combination with other policies.	Potentially low cost, but depends on programme design.	May be less effective for groups (e.g. low-income) that lack access to information.	Depends on cooperation from special interest groups.

Note:
[a] Evaluations are predicated on assumptions that instruments are representative of best practice rather than theoretically perfect. This assessment is based primarily on experiences and published reports from developed countries, as the number of peer reviewed articles on the effectiveness of instruments in other countries is limited. Applicability in specific countries, sectors and circumstances – particularly developing countries and economies in transition – may differ greatly. Environmental and cost effectiveness may be enhanced when instruments are strategically combined and adapted to local circumstances.

instruments based on their technology-stimulating effects. Consequently, it will be difficult to determine which of the available instruments is the most cost-effective. Distributional considerations are also particularly difficult to evaluate. Revesz and Stavins (2006) provide a discussion of the difficulties involved in evaluating instruments based on distribution or equity. They also cite a number of authors that propose different approaches to evaluating policies.

Nevertheless, it is possible to make general statements about each instrument according to the criteria we have selected. For example, it is generally believed that market-based instruments will be more cost effective than regulations and standards (Wiener, 1999). However, this belief implicitly assumes that a country has well-functioning institutions, the lack of which can result in a market-based instrument being more costly to implement (Blackman and Harrington, 2000). Table 13.1 summarizes the seven instruments presented in this chapter for each of the four criteria we discuss. Sterner (2003) and Harrington *et al*. (2004) provide similar summaries for other instruments.

Second, policymakers must determine how much weight to assign each of the evaluative criteria. Consider two instruments that are equally environmentally effective and both institutionally feasible, but one has unfavourable distributional implications while the other is less cost-effective. In order to choose one instrument over the other, one must assess the relative importance of distribution versus cost-effectiveness. However, the determination of just what weight should be given to each evaluative criterium is a subjective question and one left to policymakers to decide. Some authors do provide some guidelines on how policymakers can determine which evaluative criteria are the most important. Sterner (2003) argues that distributional considerations will likely be less important in an economy with relatively less inequality than in countries with large income disparities and also provides additional guidance on other criteria, including institutional

flexibility and incentive compatibility. Bell (2003) and Bell and Russell (2002) argue that institutional feasibility is of critical importance in developing countries, where environmental effectiveness and cost-effectiveness may be determined in large part by a government's institutional capacity. In general, the criteria that receive the most weight will be those that are assessed to be the most important in terms of each country's specific circumstances.

13.3 International climate change agreements and other arrangements

The context of and reasons for an international agreement were relatively well covered in IPCC (2001). The authors of more recent reports cite the reasons presented in older publications for the necessity of agreements – namely, the global nature of the problem and the fact that no single country emits more than approximately 20% of global emissions. This situation means that successful solutions will need to engage multiple countries. Similarly, the fact that no one sector is responsible for more than about 25% of global emissions (the largest sector is that of electricity generation and heat production at 24% of the global, six-gas total; see Baumert *et al*., 2005a) implies that no single sector will be uniquely required to act.

13.3.1 Evaluations of existing climate change agreements

In contrast, the more recent publications have devoted considerable attention to the limitations of existing international agreements in addressing the climate change. In fact, there are no authoritative assessments of the UNFCCC or its Kyoto Protocol that assert that these agreements have succeeded – or will succeed without changes – in fully solving the climate problem. As its name implies, the UNFCCC was designed as a broad framework, and the Kyoto Protocol's first commitment period for 2008–2012 has been its first detailed step. Both the Convention and the Kyoto Protocol include provisions for further steps as necessary.

A number of limitations and gaps in existing agreements are cited in the literature, namely:

- The lack of an explicit long-term goal means countries do not have a clear direction for national and international policy (see, for example, Corfee-Morlot and Höhne, 2003);
- The targets are inadequately stringent (Den Elzen and Meinshausen, 2005, who argue for more stringent targets);
- The agreements do not engage an adequate complement of countries (see Baumert *et al*. 1999, who suggest a need to engage developing as well as developed countries, or Bohringer and Welsch 2006, who suggest that with the US withdrawal, the Kyoto Protocol's effect is reduced to zero);
- The agreements are too expensive (Pizer, 1999, 2002);
- The agreements do not have adequately robust compliance provisions (Victor, 2001; Aldy *et al*., 2003);
- The agreements do not adequately promote the development and/or transfer of technology (Barrett, 2003);
- The agreements, as one consequence of failing to solve the problem, do not adequately propose solutions that will facilitate adaption to the forthcoming changes (Muller, 2002).

Reviews of the current agreements take several forms. Some (e.g. Depledge, 2000) provide detailed article-by-article reviews of the existing agreements, seeking to interpret the legal language as well as to provide a better understanding of their historical derivations. In this manner, they offer insight into how future agreements might be developed. Other studies assess the effect of the emission reductions required by the Kyoto Protocol on global GHG concentrations and conclude that although the effect is currently small (Manne and Richels, 1999), it may be large in the future as present-day emission reductions set the stage for future reduction efforts, which would not have happened otherwise (Höhne and Blok, 2006). Some researchers (e.g. Cooper, 2001; Michaelowa *et al*., 2005a) evaluate the basic underpinnings of the two climate agreements, looking at problems associated with establishing binding targets and differentiating between countries as well as difficulties in operationalizing the concept of emissions markets. These kinds of assessments – by far the most common – not only assess current limitations but usually proceed to put forth counter-arguments, outline improvements that should be made and propose alternative mechanisms for addressing the climate problem. See the following sections for responses and alternatives to solving the climate problem.

13.3.2 Elements of international agreements and related instruments

The majority of elements identified in the literature draw on existing multilateral agreements, in particular, the UNFCCC and its Kyoto Protocol. Agreements related to climate change, but not specifically focused on GHG mitigation, are less extensively analysed in the climate literature. These include energy policy and technology agreements (see, for example, publications the IEA evaluating their "Implementing Agreements") and the evaluation of VAs with the auto sector (see, for example, Sauer *et al*., 2005 on the European Automobile Manufacturers Association (ACEA) agreement between the European, Japanese and Korean auto manufacturers). Based on the literature in Table 13.2, it is possible to derive some common elements of international climate change agreements. These are listed in Box 13.6, and expanded upon in the section below.

13.3.3 Proposals for climate change agreements

The literature on climate change contains a large number of proposals on possible future international agreements. Table 13.2 provides a summary review of recent proposals for international climate agreements as reported in the literature (see also Bodansky, 2004; Kameyama, 2004; Philibert, 2005a), although not all proposals cover all elements that are necessary

Box 13.6 Elements for climate change agreements[31]

A number of elements are commonly incorporated in existing – and proposals for new – international climate change agreements. These include:

Goals: Most agreements establish objectives that implementation is supposed to achieve. In the climate context, a variety of goals have been proposed, including those related to emissions reductions, stabilization of GHG concentrations, avoiding "dangerous" interference with climate, technology transfer and sustainable development. Goals can be set at varying degrees of specificity.

Participation: All agreements are undertaken between specific groups of participants. Some have a global scope while others focus on a more limited set of parties (e.g. regional in nature or limited to arrangements between private sector partners). Obligations can be uniform across participants, or differentiated among them.

Actions: All agreements call for some form of action. Actions vary widely and can include national caps or targets on emissions, standards for certain sectors of the economy, financial payments and transfers, technology development, specific programmes for adaptation and reporting and monitoring. The actions can be implicitly or explicitly designed to support sustainable development. The timing for actions varies considerably, from those taking effect immediately, to ones that may take effect only over the longer term; actions may be taken internally (within contracting Parties) or with others (both with non-Parties as well as non-State actors).

Institutions and compliance provisions: Many agreements contain provisions for establishing and maintaining supporting institutions. These perform tasks as varied as serving as repositories for specific, agreement-related data, facilitating or adjudicating compliance, serving as clearing houses for market transactions or information flows, to managing financial arrangements. In addition, most agreements have provisions in case of non-compliance. These include binding and non-binding consequences and may be facilitative or more coercive in nature.

Other elements: Many (although not all) agreements contain additional elements, including, for example, "principles" and other preambular language. These can serve to provide context and guidance for operational elements, although they may be points of contention during negotiations. In addition, many agreements contain provisions for evaluating progress – with a timetable for reviewing the adequacy of efforts and evaluating whether they need to be augmented or modified.

to describe a full regime. The list of proposals is grouped around the following themes: national emission targets and emission trading, sectoral approaches, policies and measures, technology, development-oriented actions, adaptation, financing and proposals focusing on negotiation process and treaty structure.

13.3.3.1 Goals

Most agreements (including those on climate change such as the UNFCCC and the Kyoto Protocol), include specific goals to guide the selection of actions and timing as well as the selection of institutions. Goals can provide a common vision about both the near-term direction and the longer term certainty that is called for by business. In this discussion, goals are distinguished from targets: the former are long-term and systemic, while the latter relate to actions that are near-term and specific. Targets are described under the 'Targets' section (13.3.3.4.1) below.

The choice of the long-term ambition level significantly influences the necessary short-term action and, therefore, the design of the international regime. For example, if the goal is set at high stabilization levels (e.g. stabilizing concentrations at 750 ppmv CO_2-eq, scenario category D of Chapter 3 of this report), a technology-focused approach that defers emissions reduction to the future would be sufficient for the time being. For low stabilization goals (e.g. 450 ppmv CO_2-eq, category A1, or 550 ppmv CO_2-eq, category B), short-term emission reductions would be necessary in addition to technological development programmes.

International regimes can incorporate goals for the short and medium term and for the stabilization of GHG concentrations. One option is to set a goal for long-term GHG concentrations or a maximal temperature rise (such as the 2°C goal proposed by the EU). Such levels might be set based on an agreement of impacts to be avoided (see Den Elzen and Meinshausen, 2005) or on the basis of a cost-benefit analysis (see Nordhaus, 2001). A number of authors have commented on the advantages and disadvantages of setting long-term goals. Pershing and Tudela (2003) suggest that it may be difficult to gain a global agreement on any 'dangerous' level due to political and technical difficulties. Conversely, Corfee-Morlot and Höhne

31 While not an element, agreements often contain specific information as to the time for initiating actions and, often, a date by which actions are to be completed. In addition, many agreements contain provisions for evaluating progress – with a timetable for reviewing the adequacy of efforts and evaluating whether they need to be augmented or modified.

Table 13.2: *Overview of recent proposals for international climate agreements.*

Name (reference)			Description
National emission targets and emission trading			
National emission targets and emissions trading	Staged systems	Staged systems	
		Multistage with differentiated reductions: Gupta, 1998; Berk and den Elzen, 2001; Blanchard et al., 2003; Criqui *et al*., 2003; Gupta, 2003a; Höhne et al., 2003; Höhne *et al*., 2005; Michaelowa *et al*., 2005b; den Elzen and Meinshausen, 2006, den Elzen *et al*., 2006a	Countries participate in the system with different stages and stage-specific types of targets; countries transition between stages as a function of indicators; proposal specify stringency of the different stages
		Differentiating groups of countries: Storey, 2002; Ott *et al*., 2004	Countries participate in the system with different stages and stage-specific types of targets
		Converging markets: Tangen and Hasselknippe, 2005	Scenario with regional emission trading systems converging to a full global post 2012 market system
		Three-part policy architecture: Stavins, 2001	All nations with income above agreed threshold take on different targets (fixed or growth); long-term targets (flexible but stringent); short-term (firm, but moderate); and market-based policy instruments, e.g., emissions trading.
	Allocation methods	Allocation methods	
		Equal per capita allocation: Baer *et al*, 2000; Wicke, 2005	All countries are allocated emission entitlements based on their population.
		Contraction and convergence: GCI, 2005	Agreement on a global emission path that leads to an agreed long-term stabilization level for greenhouse gas concentrations ('Contraction'). Emission targets for all individual countries set so per-capita emissions converge ('Convergence').
		Basic needs or survival emissions: Aslam, 2002; Pan, 2005	Emission entitlements based on an assessment of emissions to satisfy basic human needs.
		Adjusted per capita allocation: Gupta and Bhandari, 1999	Allocation of equal per capita emissions with adjustments using emissions per GDP relative to Annex I average.
		Equal per capita emissions over time: Bode, 2004	Allocation based on (1) converging per capita emissions and (2) average per capita emissions for the convergence period that are equal for all countries.
		Common but differentiated convergence: Höhne *et al*., 2006	Annex I countries' per capita emissions converge to low levels within a fixed period. Non-Annex I countries converge to the same level in the same timeframe, but starting when their per capita emissions reach an agreed percentage of the global average. Other countries voluntarily take on "no lose" targets.
		Grandfathering: Rose *et al*., 1998	Reduction obligations based on current emissions.
		Global preference score compromise: Müller, 1999	Countries voice preference for either per capita allocation or allocation based on current national emissions.
		Historical responsibility – the Brazilian proposal: UNFCCC, 1997b; Rose *et al*., 1998; Meira Filho and Gonzales Miguez, 2000; Pinguelli Rosa *et al*., 2001; den Elzen and Schaeffer, 2002; La Rovere *et al*., 2002; Andronova and Schlesinger, 2004; Pinguelli *et al*., 2004; Trudinger and Enting, 2005; den Elzen and Lucas, 2005; den Elzen *et al*., 2005c; Höhne and Blok, 2005; Rive *et al*., 2006	Reduction obligations between countries are differentiated in proportion to those countries' relative share of responsibility for climate change – i.e. their contribution to the increase of global-average surface temperature over a certain period of time.
		Ability to pay: Jacoby *et al*., 1998; Lecoq and Crassous, 2003	Participation above welfare threshold. Emission reductions as a function of ability to pay (welfare).
		Equal mitigation costs: Rose et al., 1998; Babiker and Eckhaus, 2002	Reduction obligations between countries are differentiated so that all participating countries have the same welfare loss.
		Triptych: Blok et al., 1997; den Elzen and Berk, 2004; Höhne *et al*., 2005	National emission targets based on sectoral considerations: Electricity production and industrial production grow with equal efficiency improvements across all countries. "Domestic" sectors converge to an equal per-capita level. National sectoral aggregate levels are then adopted.
		Multi-sector convergence: Sijm *et al*., 2001	Per-capita emission allowances of seven sectors converge to equal levels based on reduction opportunities in these sectors. Countries participate only when they exceed per capita threshold.
		Multi-criteria: Ringius *et al*., 1998; Helm and Simonis, 2001; Ringius *et al*., 2002	Emission reduction obligations based on a formula that includes several variables, such as population, GDP and others.

Table 13.2: *Continued.*

Name (reference)			Description
National emission targets and emission trading			
National emission targets and emissions trading	Alternative types of emission targets for some countries	Alternative types of emission targets for some countries	
		Dynamic targets: Hargrave *et al*., 1998; Lutter, 2000; Müller *et al*., 2001; Bouille and Girardin, 2002; Chan-Woo, 2002; Lisowski, 2002; Ellerman and Wing, 2003; Höhne *et al*., 2003; Müller and Müller-Fürstenberger, 2003; Jotzo and Pezzey, 2005; Philibert, 2005b; Pizer, 2005b; Kolstad, 2006	Targets are expressed as dynamic variables – including as a function of the GDP ("intensity targets") or variables of physical production (e.g. emissions per tonne of steel produced).
		Dual targets, target range or target corridor: Philibert and Pershing, 2001; Kim and Baumert, 2002	Two emission targets are defined: (1) a lower "selling target" that allows allowance sales if national emissions fall below a certain level; (2) a higher "buying target" that requires the purchase of allowances if a certain level is exceeded.
		Dual intensity targets: Kim and Baumert, 2002	A combination of intensity targets and dual targets.
		"No lose", "non-binding", one-way targets: Philibert, 2000	Emission rights can be sold if the target is reached, while no additional emission rights would have to be bought if target is not met. Allocations are made at a BAU level or at a level below BAU. Structure offers incentives to participate for countries not prepared to take on full commitments but still interested in joining the global trading regime.
		Growth targets, headroom allowances, premium allocation: Frankel, 1999; Stewart and Wiener, 2001; Viguier, 2004	Participation of major developing countries is encouraged by unambitious allocations relative to their likely BAU emissions. To ensure benefit to the atmosphere, a fraction of each permit sold can be banked and definitely removed.
		Action targets: Goldberg and Baumert, 2004	A commitment to reduce GHG emission levels below projected emissions by an agreed date through "actions" taken domestically, or through the purchases of allowances.
		Flexible binding targets: Murase, 2005	A framework for reaching emission targets modelled after the WTO/GATT (World Trade Organization/General Agreement on Tariffs and Trade) scheme for tariff and non-tariff barriers; targets negotiated through rounds of negotiations.
	Modifications to the emission trading system or alternative emission trading system	Modifications to the emission trading system or alternative emission trading system	
		Price cap, safety valve or hybrid trading system: Pizer, 1999; Pizer, 2002; Jacoby and Ellerman, 2004.	Hybrid between a tax and emission trading: after the initial allocation, an unlimited amount of additional allowances are sold at a fixed price.
		Buyer liability: Victor, 2001b	If the seller of a permit did not reduce its emissions as promised, the buyer could not claim the emission credit. Enforcement is more reliable as buyers deal with developed countries with more robust legal procedures.
		Domestic hybrid trading schemes: McKibbin and Wilcoxen, 1997; McKibbin and Wilcoxen, 2002	Two kinds of emissions permits valid only within the country of origin. (1) long-term permits entitle the permit owner to emit 1 tC every year for a long period; permits are distributed once. (2) Annual permits allow 1 tC to be emitted in a single year. An unlimited number of these permits are given out at a fixed price (price cap). Compliance is based on either unit.
		Allowance purchase fund: Bradford, 2004	Countries contribute to an international fund that buys/retires emission reduction units. Countries can sell reductions below their BAU levels.
		Long-term permits: Peck and Teisberg, 2003	Long-term permits could be used once at any time between 2010 and 2070. Depending on the time of emission they are depreciated 1% annually for atmospheric decay of CO_2. The permit would allow the emission of 1 tC in 2070, 1.01 tC in 2069 and 1.0160 (1.71) tons in 2010.

Table 13.2: *Continued.*

Name (reference)		Description
Sectoral approaches	Sectoral approaches	
	Sector Clean Development Mechanism, sector Crediting Mechanism : Philibert and Pershing, 2001; Samaniego and Figueres, 2002; Bosi and Ellis, 2005; Ellis and Baron, 2005; Sterk and Wittneben, 2005	Sectoral crediting schemes based on emission reductions below a baseline. Excess allowances can be sold.
	Sector pledge approach: Schmidt et al., 2006	Annex I countries have emission targets, with the ten highest-emitting developing countries pledging to meet voluntary, "no-lose" GHG emissions targets in the electricity and major industrial sectors. Targets are differentiated, based upon national circumstances, and sector-specific energy-intensity benchmarks are developed by experts and supported through a Technology Finance and Assistance Package.
	Caps for multinational cooperation: Sussman *et al*., 2004	A cap/and trade system associated with the operations of associated enterprises in developing and developed countries.
	Carbon stock protocol: WBGU, 2003	A protocol for the protection of carbon stocks based on a worldwide system of "non-utilization obligations" to share the costs of the non-degrading use of carbon stocks among all states.
	"Non-binding" targets for tropical deforestationa: Persson and Azar, 2004	Non-binding commitments for emissions from deforestation under which reduced rates of deforestation could generate emissions allowances.
Policies and measures	Policies and measures	
	Carbon emission tax: Cooper, 1998; Nordhaus, 1998; Cooper, 2001; Nordhaus, 2001; Newell and Pizer, 2003	All countries agree to a common, international GHG emission tax; several of the proposals suggest beginning with a carbon tax limited to emissions from fossil fuel combustion.
	Dual track: Kameyama, 2003	Countries choose either non-legally binding emission targets based on a list of policies and measures or legally-binding emission caps allowing international emissions trading.
	Climate "Marshall Plan": Schelling, 1997, 2002	Financial contributions from developed countries support climate friendly development; similar in scale and oversight to the Marshall Plan.
Technology	Technology	
	Technology research and development: Edmonds and Wise, 1999; Barrett, 2003	Enhanced coordinated technology research and development.
	Energy efficiency standards: Barrett, 2003; Ninomiya, 2003	International agreement on energy efficiency standards for energy-intensive industries.
	Backstop technology protocol: Edmonds and Wise, 1998	New power plants installed after 2020 must be carbon neutral. New synthetic fuels plants must capture CO_2. Non-Annex I countries participate upon reaching Annex I average GDP in 2020.
	Technology prizes for climate change mitigation: Newell and Wilson, 2005	Incentive or inducement prizes targeted at applied research, development and demonstration.
Development-oriented actions	Development-oriented actions	
	Sustainable development policies and measures: Winkler *et al*., 2002b; Baumert *et al*., 2005b	Countries integrate policies and measures to reduce GHG emissions into development plans (e.g. developing rural electrification programmes based on renewable energy, or mass transit systems in placed of individual cars).
	Human development goals with low emissions: Pan, 2005	Elements include: identification of development goals/basic human needs; voluntary commitments to low carbon paths via no-regret emission reductions in developing countries conditional to financing and obligatory discouragement of luxurious emissions; reviews of goals and commitments; an international tax on carbon.

Table 13.2: *Continued.*

Name (reference)		Description
Adaptation	Adaptation	
	UNFCCC impact response instrument: Müller, 2002	A new "impact response instrument" under the auspices of the UNFCCC for disaster relief, rehabilitation and recovery.
	Insurance for adaptation; funded by emission trading surcharge: Jaeger, 2003	A portion of the receipts from sales of emissions permits would be used to finance insurance pools.
Financing	Financing	
	Greening investment flows: Sussman and Helme, 2004	Investments through Export Credit Agencies are conditional on projects that are "climate friendly".
	Quantitative finance commitments: Dasgupta and Kelkar, 2003	Annex I countries take on quantitative financial commitments – e.g. expressed as a percentage of the GDP – in addition to emission reduction targets.
Negotiation process and treaty structure	Negotiation process and treaty structure	
	Bottom-up or multi-facet approach, pledge (with review) and review: Reinstein, 2004; Yamaguchi and Sekine, 2006	Each country creates its own initial proposal relating to what it might be able to commit to. Individual actions accumulate one by one. The collective effect of proposals is periodically reviewed for adequacy and – if necessary – additional rounds of proposals are undertaken.
	Portfolio approach: Benedick, 2001	A portfolio including: emission reduction policies, government research/ development, technology standards and technology transfer.
	A flexible framework: PEW, 2005	A portfolio including: aspirational long-term goals, adaptation, targets, trading, policies, and technology cooperation.
	Orchestra of treaties: Sugiyama et al., 2003	A system of separate treaties among like-minded countries (emission markets, zero emission technology, climate-wise development) and among all parties to UNFCCC (monitoring, information, funding).
	Case study approach: Hahn, 1998	Multiple case studies of coordinated measures, emissions tax, tradable emission permits and a hybrid system in industrialized countries to learn by doing.

Note:

a There is some potential conflict with the terminology here: "non-binding" targets may be interpreted by some as restricting the capacity of countries to trade as they do not necessarily set up caps that impose prices and thus established tradable commodities.

Source: Earlier overviews by Bodansky, 2004; Kameyama, 2004; Philibert, 2005a

(2003) believe such goal-setting is desirable as it helps structure commitments and institutions, provides an incentive to stimulate action and helps establish criteria against which to measure the success of implementing measures.

An alternative to agreeing on specific CO_2 concentration or temperature levels is an agreement on specific long-term actions (such as a technology-oriented target, such as 'eliminating carbon emissions from the energy sector by 2060'). An advantage of such a goal is that it might be linked to specific actions. While links between such actions, GHG concentrations and climate impacts can be made, there are uncertainties in the precise correlation between them. Additionally, several different targets would have to be set to cover all climate-relevant activities (Schelling, 1997; Pershing and Tudela, 2003).

Another option would be to adopt a 'hedging strategy' (IPCC, 2001, chapter 10), which is defined as a shorter term goal on global emissions, from which it is still possible to reach a range of desirable long-term goals. One example of such a strategy is the California goal of reducing emissions to 1990 levels by 2020, and then reducing them to 80% below 1990 levels by 2050. Once the short-term goal is reached, decisions on subsequent steps can be made in light of new knowledge and decreased levels of uncertainty. To implement this option, the international community could agree on a maximum quantity of permissible GHG emissions in, for example, 2020 (Corfee-Morlot and Höhne, 2003; Pershing and Tudela, 2003; Yohe *et al*., 2004).

Another proposal would be to aim at formulating reductions step by step, based on the willingness of countries to act, without explicitly considering a long-term perspective. While such an approach does meet political acceptability criteria, it poses the risk that the individual reductions may not add up to the level required for certain stabilization levels. Some stabilization options may then be out of reach in the near future (see Chapter 3.3, Figure 3.19).

13.3.3.2 Participation

The participation of states in international agreements can vary. At one extreme, participation can be universal; at the other extreme, participation can be limited to just two countries. Many studies propose that participation can be differentiated in different tiers (see Staged systems in Table 13.2). States participating in the same tier would have the same

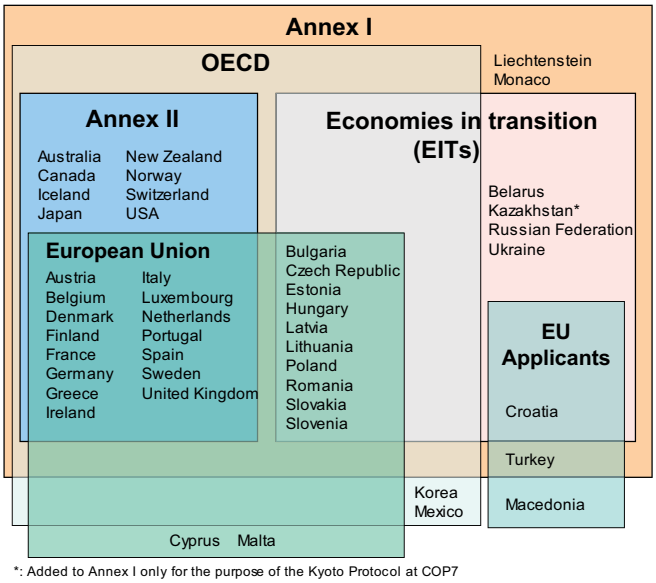


Figure 13.2: *Current country groupings under the UNFCCC, OECD and EU.*
Source: Höhne et al. (2005).

type of commitments (i.e. in the UNFCCC regime). The most important tiers are Annex I and non-Annex I, but there are also special arrangements for economies in transition as well as for least developed countries. Figure 13.2 shows the groupings of countries under the UNFCCC, OECD and EU. The allocation of states into tiers can be made according to quantitative or qualitative criteria or 'ad hoc' (see Table 13.2). According to the principle of sovereignty, states may also choose the tier in which they want to be grouped, provided their choice is accepted by other countries (see Kameyama, 2003; Reinstein, 2004).

Participation in the agreement can be static[32], or it may change dynamically over time. In the latter case, states can "graduate" from one tier of commitments to the next. Graduation can be linked to the meeting of quantitative thresholds for certain parameters (or combinations of parameters) that have been predefined in the agreement, such as emissions, cumulative emissions, GDP per capita, relative contribution to temperature increase or other measures of development, such as the human development index (see Berk and Den Elzen (2001), Gupta (1998, 2003a) and Höhne *et al*. (2003) for a review of per-capita emissions thresholds; Criqui *et al*. (2003) and Michaelowa *et al*. (2005b) for discussion of a composite index using the sum of per-capita emissions and per-capita GDP and Torvanger *et al*. (2005) for further composite indices). Qualitative thresholds such as adherence to certain country groupings (OECD, Economies in Transition) are already in use. Ott *et al*. (2004) combine quantitative and qualitative thresholds. Thresholds can be derived from agreed-upon GHG concentration targets or global emissions paths or be based on other parameters, such as willingness or capacity to pay.

Some have argued that an international agreement needs to include at least the major emitters to be effective, since the largest 15 countries (the EU25 is considered here to be one country) produce as much as 80% of global GHG emissions (Baumert *et al*., 2005a; PEW, 2005; Stewart and Weiner, 2003; Torvanger *et al*., 2005; Schmidt *et al*., 2006). A similar approach has been taken by authors comparing climate change agreements to other multilateral instruments, including disarmament treaties and the Antarctic Treaty (see Murase, 2002a). In these analyses, the authors assert that success can only be achieved if the major stakeholders act. Thus, for example, a nuclear disarmament treaty would be meaningless if it was not ratified by those States with nuclear weapons, even if it was ratified by the 180 non-nuclear States. By analogy, a climate change treaty is meaningful only if commitments are adopted and implemented by the major emitters – noting that the benefits of participation accrue to all countries, including those not taking part in the agreement. Murase (2002a) suggests that a future regime after 2012 thus needs to include key countries or groups such as the USA, EU, Japan, China, India, Korea, Mexico, Brazil, Indonesia, South Africa and Nigeria.

Much of the literature on game theory suggests that the conditions necessary for achieving large-scale stable coalitions mean that relatively modest emissions reductions will be achieved (e.g. Carraro and Siniscalco, 1993; Hoel and Schneider, 1997). Cooperative game theory emphasizes the prospect of building stable coalitions if a transfer scheme (e.g. by emissions trading) can allocate the gains from cooperation in proportion to the benefits from reduced climate impacts (e.g. Chander and Tulkens, 1995; Germain *et al*., 1998; Germain *et al*., 2003). Eykmans and Finus (2003) note that much of the literature focuses on a 'grand (all party) coalition, analyses stability in terms of the aggregate payoff to coalitions and rests on very strong assumptions about implicit punishment of any free-riding countries.' A more extensive discussion of the issues of free-riding is contained in Chapter 10 of the TAR.

Alternative assumptions can provide a richer understanding of possible factors relevant to an agreement by relating relate to the response to payoffs from cooperation, including spillover and trade effects, allowing for the development of multiple coalitions and recognizing trade and the role of technology transfer as well as the potential for other transfer schemes (Tol *et al*., 2000; Finus, 2002; Kemfert *et al*., 2004). They also increase the possibility that partial cooperation (including involving more than one coalition) can close the gap between the global optimum (full cooperation) and "no cooperation" by a substantial amount. While this is essentially a theoretical conclusion (based in some cases on modelling reflecting some empirical evidence), it provides some basis for suggesting that it is too restrictive to assume that a single, all-encompassing global intergovernmental agreement is a *necessary* condition

32 For example, participation in the tiers of commitments of the Kyoto Protocol can only be changed by an amendment which has to be ratified by all parties. As this is extraordinarily difficult, membership in the tiers is essentially fixed.

for effective mitigation action.

Some authors (see, for example, Muller, 2002; Jaeger, 2003) suggest that a climate regime is not exclusively about mitigation but that it also encompasses adaptation and, as such, far wider arrays of countries are vulnerable to climate and must be included in any agreement. Further, several authors (e.g. Meira Filho and Gonzales, 2000; Pan, 2005) argue that even if the majority of emissions are the responsibility of only a few nations, all countries must share the commitments to reduce these for reasons of equity and fairness (recognizing that such actions should be differentiated according to responsibility and capability). Other rationales for global engagement are also used, including that if only some major countries participate, the emissions of non-participating countries could increase by the migration of emission-intensive industries. Therefore, most proposals aim to provide incentives for countries to participate. Some aim at pull incentives, such as temporary over-allocation or no regret structures; others mention push incentives, such as trade sanctions or border tax adjustments (Kuik, 2003; Biermann and Brohm, 2005).

Other authors argue that countries have differentiated historical responsibility and that such a sub-global participation can be effective: Grubb *et al*. (2002) argue that under some scenarios one can expect that technology development driven by the international climate regime in Annex I countries could offset some or all emissions leakage in non-Annex I countries. Sijm (2004) notes that a number of policies could promote this spillover effect in the longer term. These types of policies include international cooperation on Research, Development and Demonstration (RD&D), promoting open trade or using the Clean Development Mechanism. Others argue that with the participation of some large countries, other countries cannot lag behind and that the climate regime should look for that 'tipping point' (Barrett, 2003).

In general, the literature suggests that actions can occur in parallel and that international agreements could have multiple components, since national circumstances are so diverse. However, the suggestion is also made that care should be taken, particularly for countries with limited institutional capacity, to avoid creating too many simultaneous international activities.

13.3.3.3 Implications of regime stringency: linking goals, participation and timing

Several studies have analysed the regional emission allocations or requirements on emission reductions and time of participation in the international climate change regime with the aim of being able to ensure different concentration or temperature stabilization targets (Berk and den Elzen, 2001; Blanchard, 2002; Winkler *et al*., 2002a; Criqui *et al*., 2003; WBGU, 2003; Bollen *et al*., 2004; Groenenberg *et al*., 2004; Böhringer and Löschel, 2005; den Elzen and Meinshausen, 2005; den Elzen and Lucas, 2005, den Elzen *et al*., 2005c; Höhne *et al*., 2005; Michaelowa *et al*., 2005a; Böhringer and Welsch, 2006; Höhne, 2006; Persson *et al*., 2006). A large variety of system designs for allocating emission allowances/permits were analysed, including contraction and convergence, multistage, Triptych and intensity targets. The studies cover a broad spectrum of parameters and assumptions that influence these results, such as population, GDP development of individual countries or regions, global emission pathways that lead to climate stabilization (including overshooting the desired concentration level), parameters for the thresholds for participation and ways to share emission allowances. For example, the studies include very stringent requirements for developed countries with more lenient requirements for developing countries as well as less stringent requirements for developed countries and more ambitious constraints for developing countries within a plausible range. The conclusions of these studies and their implications for international regimes can be summarized as follows:

- Under regime designs for low and medium concentration stabilization levels (i.e. 450 and 550 ppm CO_2-eq, category A and B; see Chapter 3, Table 3.10) GHG emissions from developed countries would need to be reduced substantially during this century. For low and medium stabilization levels, developed countries as a group would need to reduce their emissions to below 1990 levels in 2020 (on the order of –10% to 40% below 1990 levels for most of the considered regimes) and to still lower levels by 2050 (40% to 95% below 1990 levels), even if developing countries make substantial reductions. The reduction percentages for individual countries vary between different regime designs and parameter settings and may be outside of this range. For high stabilization levels, reductions would have to occur, but at a later date (see Box 13.7).
- Under most of the considered regime designs for low and medium stabilization levels, the emissions from developing countries need to deviate – as soon as possible – from what we believe today would be their baseline emissions, even if developed countries make substantial reductions. For the advanced developing countries, this occurs by 2020 (mostly Latin America, Middle East and East Asia). For high stabilization levels, deviations from the reference level are necessary only at a later date.
- Reaching lower levels of GHG concentrations requires earlier reductions and faster participation compared to higher concentrations.
- For many countries, the overall target set is critical; it dictates the emissions reduction requirements more specifically than does the approach chosen to meet that target.
- The wide diversity of approaches means that not all countries participate under all regimes – even if an identical concentration target is achieved. Obviously, required national actions differ enormously, depending on whether a country participates in a system. However, the difference in reductions required between the various approaches is small for participating countries.

Box 13.7 The range of the difference between emissions in 1990 and emission allowances in 2020/2050 for various GHG concentration levels for Annex I and non-Annex I countries as a group[a]

Scenario category	Region	2020	2050
A-450 ppm CO_2-eq[b]	Annex I	–25% to –40%	–80% to –95%
	Non-Annex I	Substantial deviation from baseline in Latin America, Middle East, East Asia and Centrally-Planned Asia	Substantial deviation from baseline in all regions
B-550 ppm CO_2-eq	Annex I	-10% to -30%	-40% to -90%
	Non-Annex I	Deviation from baseline in Latin America and Middle East, East Asia	Deviation from baseline in most regions, especially in Latin America and Middle East
C-650 ppm CO_2-eq	Annex I	0% to -25%	-30% to -80%
	Non-Annex I	Baseline	Deviation from baseline in Latin America and MIddle East, East Asia

Notes:

[a] The aggregate range is based on multiple approaches to apportion emissions between regions (contraction and convergence, multistage, Triptych and intensity targets, among others). Each approach makes different assumptions about the pathway, specific national efforts and other variables. Additional extreme cases – in which Annex I undertakes all reductions, or non-Annex I undertakes all reductions – are not included. The ranges presented here do not imply political feasibility, nor do the results reflect cost variances.

[b] Only the studies aiming at stabilization at 450 ppm CO_2-eq assume a (temporary) overshoot of about 50 ppm (See Den Elzen and Meinshausen, 2006).

Source: See references listed in first paragraph of Section 13.3.3.3

Several studies have gone one step further and have, based on emission allocations, calculated emission reduction costs and possible trades of emission allowances at a regional level for different concentration or temperature stabilization targets (Criqui *et al*., 2003; WBGU, 2003; Bollen *et al*., 2004; Böhringer and Welsch, 2004, 2006; Böhringer and Löschel, 2005; den Elzen and Lucas, 2005; den Elzen *et al*., 2005c; Persson *et al*., 2006). Researchers have also analysed a large variety of system designs. With cost analysis even more assumptions are relevant, such as detailed assumptions on emission reduction costs per sector and region. Costs have been calculated using a variety of models, ranging from those with detailed sectoral representation focussing on the technological aspects to macroeconomic models focussing on the economy as a whole. How (and what) costs are calculated plays a role. Some studies present annual direct mitigation costs (only direct abatement costs) or energy costs, such as mitigation costs and costs of losses of fossil fuel exports or gains from increased exports of biofuels. Other studies present full macro-economic costs, calculated as (cumulative) GDP losses in a specific target year. The cumulative impact of climate policies on GDP may be lower than expected from the annual abatement costs levels due to the fact that climate policy leads mostly to the substitution of investments and activities and much less to an overall reduction of the GDP. The conclusions of these studies on costs can be summarized as follows:

Global costs

- The total global costs are highly dependent on the baseline scenario, marginal abatement costs estimates, the participation level in emission trading and the assumed concentration stabilization level (see also Chapter 11).
- The total global costs does not vary significantly for the same global emission level; however, costs will vary with the degree of participation in emission trading (how and when allowances are allocated). If, for example, some major emitting regions do not participate in the reductions and in emission trading immediately, the global costs of the participating regions may be higher (see also Chapter 3, e.g. Bollen *et al*., 2004; den Elzen *et al*., 2005c).

Regional costs

- Regional abatement costs are largely dependent on the assumed stabilization level and baseline scenario. The allocation regime is also an important factor, although in most countries the extent of its effect is less than that of the stabilization level (see Criqui *et al*., 2003; den Elzen and Lucas, 2005; den Elzen *et al*., 2006b). The allocation parameter having the largest effect is the timing of participation. Under a staged approach, whether a region participates early or late is of great importance. If, for example, convergence of the per capita emissions were to occur by the end of this century, developing regions

would incur high costs relative to what might occur in the reference or baseline cases. Conversely, if convergence were to occur by the middle of the century, developed countries would incur higher costs relative to what they might incur in a reference or baseline case (see Nakicenovic and Riahi, 2003; den Elzen *et al*., 2005a; Persson *et al*., 2006).

- Abatement costs (only costs from reducing emissions) as a percentage of GDP vary significantly by region for allocation schemes that ultimately lead to convergence in per capita emissions by the middle of this century. The costs are above the global average for the Middle East and the Russian Federation, including surrounding countries, and – to a lesser extent – for Latin America. The costs are near the world average for the OECD regions and below the world average for China. The other developing regions, such as Africa and South-Asia (India), experience low costs or even gains as a result of financial transfers from emission trading. (Criqui *et al*., 2003; den Elzen and Lucas, 2005).
- In addition to the abatement costs of reducing emissions, other costs arise from changes in international trade. Fossil fuel-exporting regions are also likely to be affected by losses in coal and oil exports compared to the baseline, while some regions could experience increased bio-energy exports (i.e. the Russian Federation and South America) (see Nakicenovic and Riahi, 2003; van Vuuren *et al*., 2003; Persson *et al*., 2006; and also Chapter 11).
- The economic impacts in terms of welfare changes show a similar pattern for different allocation schemes. For example, allocation schemes based on current emissions (sovereignty) lead to welfare losses for the developing countries. Allocation schemes based on a per capita convergence lead to welfare gains for developing countries, without leading to excessive burdens for industrialized countries. (Böhringer and Welsch, 2004)

13.3.3.4 Actions

13.3.3.4.1 Targets

While many types of commitments are identified in the literature on climate change, the most frequently evaluated commitment is that of the binding absolute emission reduction target as included in the Kyoto Protocol for Annex I countries. The broad conclusion that can be drawn from the literature is that such targets provide certainty about future emission levels of the participating countries (assuming targets will be met). These targets can also be reached in a flexible manner across GHGs and sectors as well as across borders through emission trading and/or project-based mechanisms (in the Kyoto Protocol case, this is referred to as Joint Implementation (JI) and as the Clean Development Mechanism (CDM).

One crucial element is defining and agreeing on the level of the emission targets. Examples of processes to agree on a target include:

- Participating countries make proposals (pledges) for individual reductions on a bottom-up basis. This approach has the risk that proposed reductions may not be adequate to lead to the desired stabilization levels.
- A common formula can be agreed upon for determining the emission targets. This rule could lead to reduction percentages for each individual country (which could subsequently be modified by negotiations).
- An overall target can be given to a group of countries, with the group deciding internally on how to share the target amongst the participants. This approach has been applied to the EU for the purpose of the Kyoto Protocol. It could, in principle, also be applied to any other group of countries.

Many authors have raised concerns that the absolute or fixed targets may be too rigid and cap economic growth (Philibert and Pershing, 2001; Höhne *et al*., 2003; Bodansky, 2004). To address these concerns, a number of more flexible national emission targets have been proposed (see alternative types of emission targets in Table 13.2). These options aim at maintaining the advantages of international emissions trading while providing more flexibility to countries to avoid extremely high costs and, thereby, potentially allowing for the adoption of more stringent targets. However, this flexibility reduces the certainty that a given emission level will be reached. Thus, there is a trade-off between costs and certainty in achieving an emissions level (see Jotzo and Pezzey, 2005). Other disadvantages that have been mentioned are adding to the complexity of the system or, in the case of intensity targets, the difficulty in coping with economic recession as well as the potential for creating ambiguity for market investors.

Additional understanding comes from the political science literature which emphasizes the importance of analysing the full range of factors bearing on decisions by nation states, including domestic pressures from the public and affected interest groups, the role of norms and the contribution of NGOs (environment, business and labour) to the negotiation processes. Studies of the European Acid Rain Regime have revealed, for example, that although agreements on an ambitious target can serve as a driver for policy implementation, they may not necessarily result in a good environmental consequence if the countries involved do not have the capacity to comply with what they have committed themselves to in good faith (Victor, 1998). While such case study-based analyses yield conclusions that are dependent on the choice of cases and the manner in which the analysis is carried out, they can provide insights which are more accessible to policymakers than more quantitative economic analyses.

13.3.3.4.2 Flexibility provisions

Many environment agreements seek to address complex issues by allowing for additional flexibility as a means to achieve their goals. Flexibility has been suggested as to 'how', 'when', 'where' and 'what' emissions are to be reduced. In the climate change context, emission reductions under an international

agreement can conceptually be achieved any 'where' on the globe. It is also possible to shift the timing ('when') of emission reductions (depending on the emission pathway), the 'how' (i.e. choice of policy instrument) and the 'what' in terms of the specific emission source or sink that is the target of the policy.

The Kyoto Protocol incorporates three articles that provide flexibility as to 'where' emission reductions occur, namely, through provisions on international emission trading, JI and the CDM. Under Kyoto's international ETS, emission allowances may be traded between governments of Annex B parties if a surplus occurs in one country. Emission reductions achieved through projects between Annex I countries are called JI, while emission reduction projects located in non-Annex I countries are called CDM projects. Extensive rules have been agreed upon to ensure that credits created under these project mechanisms actually represent the emissions reduced.

International Emissions Trading

Emissions' trading has become an important implementation mechanism for addressing climate change in many countries. The overall value of the global carbon market was over 10 billion US$ in 2005, and in the first quarter of 2006 the transaction level reached 7.5 billion US$ (World Bank and IETA, 2006). The most advanced ETS is that developed by the EU. While this system is an international one, it bears many of the characteristics of a national programme, with oversight by the European Commission and a centralized regulatory and review mechanism (see Box 13.4 for details, including those on trading prices and volumes). A larger global system of international trading is slowly developing through emission credits generated by the project-based mechanisms[33]. Theoretically, a fully global ETS would provide market players and policymakers with information thus far absent from decision-making: the actual, unfettered, global cost of GHG mitigation in a range of economic activities. In this context, at the international level, such a regime would mirror the information provided by national trading programmes at a global scale.

Lecocq and Capoor (2005) note that while the international GHG emissions market remains fragmented, trading activity has increased substantially during the last 5 years. According to their analysis, regional, national and sub-national trading programmes are all operating under different rules, which could inhibit 'market convergence' and increase the costs of trading. Others indicate that a global market can incorporate diverse domestic and regional systems despite differences in design; they reiterate the point made by others that such a system may be significantly less efficient that a single globally optimized regime (Baron and Philibert, 2005).

A full assessment of the elements required to link multiple regimes is provided by Haites (2003a), who identifies only a few situations that might prevent linkages (a formal prohibition in one system to allow links, and circumstances where a single firm's membership in multiple programmes creates the potential for double counting). However, issues that could complicate links between two or more emissions trading programmes include concerns on the effectiveness of compliance enforcement and on whether the linked regimes provide adequate protection of either system's environmental objectives. As Bygrave and Bosi (2004a,b) note, links do not need to be formal; market arbitrage can provide opportunities for purchasing allowances in multiple markets even if there is no specific recognition of one system's permits under another's structure.

Various authors have analysed the size of the allowance surplus of the countries in transition, barriers to accessing allowances, the potential market power of cartels and links to energy security. Such surpluses can alter the overall costs of compliance with the Kyoto commitments – but only if trade in such surplus allowances is undertaken. Victor *et al*. (2001a) estimated the joint Russian and Ukrainian surplus at 3.7 billion tCO_2 for the entire commitment period 2008–2012. Berkhout and Smith (2003) estimate the surplus level of the former Soviet Union through to 2030 and state that it could only cover half of an assumed 30% reduction target for a 28-member state EU. Golub and Strukova (2004) see the Russian surplus as being up to 3 billion tCO_2, arguing that due to barriers in the Russian capital market, forward trading with OECD countries represents the only opportunity to raise initial capital to mobilize no-regret and low-cost GHG reductions. Maeda (2003) shows that permits for surplus emissions in the international emissions trading regime may affect the economic efficiency of the Kyoto mechanism and suggests that considerable market power exerted by sellers could affect the price (e.g. if all of the economies in transition form a cartel, if Ukraine forms a cartel with Russia or even if Russia acts alone). Kuik (2003) sees a trade-off between economic efficiency, energy security and carbon dependency with respect to the EU acquisition of Russian and Ukrainian assigned amount units. One proposal for reducing concerns over trading in surplus allowances is that of the 'Green Investment Scheme', in which revenues from sales of surplus allowances are spent on national policies, programmes and projects to further reduce emissions; this option is explained further below.

Project-based mechanisms (Joint Implementation and the Clean Development Mechanism)

The earliest project-based mechanism of the UN Climate Convention process was the pilot phase of 'Activities Implemented Jointly' (AIJ). Most of the 150 AIJ projects were small, and many were only partially implemented due to the lack of financing that resulted from the lack of emissions credits. Only half a dozen investor countries and even fewer host countries developed real, national AIJ programmes. Selection criteria for AIJ programmes often delayed the acceptance of

33 The EU ETS has also an international component as it involves cross-border trades and transactions between national allowance registries.

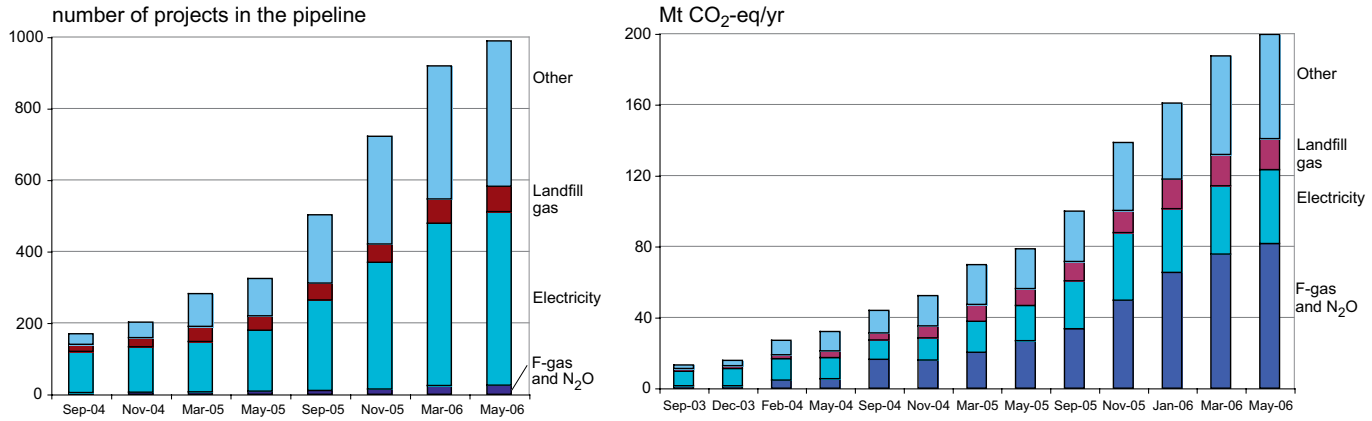


Figure 13.3: *Evolution of the Clean Development Mechanism portfolio in terms of CO_2 -equivalents per year and number of projects.*
Source: Ellis and Karousakis (2006).

projects, and most that were undertaken were commercially viable only if additional financing was provided by a separate investment subsidy (Michaelowa, 2002).

Since 2000, the CDM has allowed crediting of project-based emission reductions in developing countries; this is the first of the Kyoto Protocol's market mechanisms to be implemented. A number of analysts have estimated CDM volume and price. Chen (2003) derived prices of 2.6–4.9 US$/t$CO_2$ and annual volumes of approximately 600–1000 million certified emissions reductions (CERs). Jotzo and Michaelowa (2002) and Michaelowa and Jotzo (2005) model an annual CER demand of 360 million tCO_2 and a price of 3.6 €/tCO_2. Springer and Varilek (2004) predict a likely CER price of less than 10 US$/t$CO_2$ in 2010. CER prices increased from approximately 3 €/tCO_2 in 2003 to more than 20 €/ton in early 2006 (at the time of peak prices in the EU ETS); as of October 2006, they had declined to about 13 €/tCO_2. CER prices have been relatively closely tied to EU ETS prices over time.

As of May 2006, the volume of CERs estimated from nearly 1000 proposed projects in 69 countries was 200 MtCO_2-eq/year in 2008–2012 and 330 Mt MtCO_2-eq/year in the pre-2008 period (Ellis and Karousakis, 2006; specific project information can be found at http://cdm.unfccc.int; recent updates on the CDM/JI pipeline can also be found at the UNEP/RISO site, www.cd4cdm.org/publications/CDMpipeline.xls) (See Figure 13.3). While not all projects will be implemented, the UNFCCC cites 491 registered projects and estimates CERs equal to 740 MtCO_2-eq from those projects through to the end of 2012.[34] Ellis and Karousakis (2006) also indicate that almost half of the proposed CDM projects are in the electricity sector and that many are small renewable projects occurring in 40 countries. However, the majority of credits have come from CDM projects reducing nitrous oxide (N_2O), trifluoromethane (HFC-23) and, to a lesser extent, methane (CH_4). Projects that have not yet had methodologies approved will be under-represented in the project mix – even if they represent opportunities for significant emissions reductions at the national or global level. Publicly committed budgets for CER acquisition stood at approximately 7.5 billion US$ (World Bank, 2006) (See Figure 13.4). At such a scale, the CDM begins to reach the same order of magnitude as Global Environment Facility (GEF) and Official Development Assistance (ODA) resources.

It was initially assumed that CDM projects would be undertaken as bilateral arrangements between Annex I and non-Annex I convention Parties (and private sector companies in those countries). As of October 2006, 56% of registered projects were being undertaken unilaterally, indicating that companies in developing countries are procuring the financing to implement projects and sell the CERs to industrialized countries.[35]

A CDM project has to go through an elaborate project cycle that includes external validation and which has been defined by a decision of the 7th Conference of the Parties to the UNFCCC (2001) and is in keeping with the decisions of the CDM Executive Board that is overseeing the project cycle (see, for example, UNFCCC, 2003a–c). As CDM projects are implemented in countries without emissions targets, project 'additionality' becomes important to avoid generating fictitious emission reduction credits through 'business as usual' activities. Several tests of additionality have been discussed in the literature; these include investment additionality (see Greiner and Michaelowa, 2003) and environmental additionality (see Shrestha and Timilsina, 2002). The CDM Executive Board has developed an additionality tool that project proponents can use to test and demonstrate the additionality of a CDM project (http://cdm.unfccc.int/methodologies/PAmethodologies/Additionality_tool.pdf).

34 As of January 22, 2007. See: http://cdm.unfccc.int
35 The CDM Executive Board at its 18th meeting decided that registration can take place without an Annex I Party being involved at the time of registration. An Annex I partner would need to issue a letter of approval after registration in order to receive the CERs.

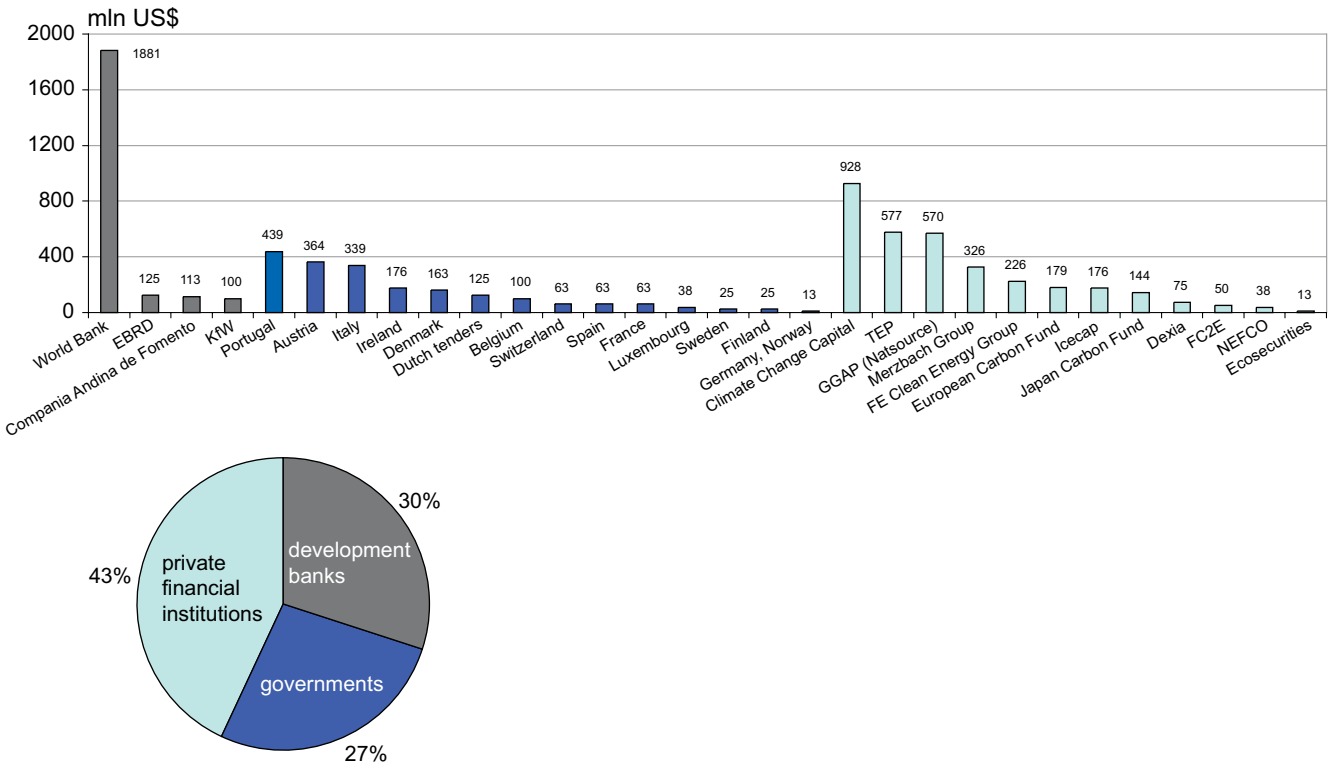


Figure 13.4: *Budgets for the acquisition of certified emissions reductions (CERs) and emission reductions units (ERUs).*
Note: Status as of October 10, 2006 at which time the total budget was almost € 6 billion.

If a project is additional, the next step is to determine a 'baseline' – the emissions that would have occurred if the project had not taken place. One potential risk is the overestimation of baseline emissions, which is a major problem as all participants profit from an overestimate as there is then no incentive to correct it. Stringent rules and modalities are required for determining baselines affecting the efficient processing of the CDM (Bailey *et al*., 2001). Fischer (2006) argues that due to pressure from industry, rules for standard emission rates are likely to be systematically biased to over-allocation and also risk creating inefficient investment incentives. Alternatively, Broekhoff (2004) focuses on costs and efficiency, arguing that the availability of data and the level of data aggregation determine to a large extent the cost of deriving multi-project baselines. Other authors examine specific baseline issues in the energy sector, particularly the use of models, the need to consider size, vintage, generation type and operational characteristics and issues relating to technology and sectoral approaches (see Fichtner *et al*., 2001; Zhang *et al*., 2001; Spalding-Fecher *et al*., 2002; Begg and Van der Horst, 2004; Illum and Meyer, 2004; Kartha *et al*., 2004; Rosen *et al*., 2004; Sathaye *et al*., 2004).

In order to account for any emissions that occur outside of the CDM project boundary but which are a consequence of the CDM project – emissions referred to a 'carbon leakage' – a CDM project should also include a leakage estimate. According to the UNFCCC CDM glossary of terms, leakage is defined as the net change of anthropogenic emissions by sources of GHGs that occur outside the project boundary and which is measurable and attributable to the activity of the CDM project. Leakage issues have been discussed by a number of authors (see, for example, Geres and Michaelowa (2002) and Kartha *et al*. (2002) for the electricity sector and the Working Group on Baseline for CDM/JI Project (2001)). There is a general consensus that the determination of project boundaries is critical to any evaluation of leakage.

The coverage of forestry and forest-related projects is a contentious issue under the CDM. The problems primarily relate to the impermanence of the forest and to leakage to other regions. Dutschke (2002) suggests leasing CDM credits to address the non-permanence of forestry sinks. The CDM has addressed the issue of non-permanence through the creation of separate CDM credits, which are called temporary CERs. According to Nelson and de Jong (2003), development priorities can be lost. This is illustrated by the case of a forestry project in Chiapas in which Mexico shifted from a development emphasis with multiple species to two species when the focus changed to carbon sales by individual farmers. Data (or its scarcity) as well as price uncertainty also pose problems. Vöhringer (2004) notes that establishing historical deforestation rates is a major problem in Costa Rica. Van Vliet *et al*. (2003) analysed six proposed plantation forestry projects in Brazil for uncertainty and, based on their results, they suggest that fluctuations in product prices

cause variations of up to 200% in CERs and net present value, leading to difficulties in determining the additionality of such projects, thereby making five of the six projects ineligible for CDM.

Perhaps the most critical issue in the context of the viability of the CDM over the longer term is whether there will be an ongoing price signal that encourages both emission reduction commitments and a market demand – over the longer term. This will clearly depend on the shape of both international agreements and evolving national programmes that might support project offsets. Independent of the market demand issues, an important suggestion to enhance the CDM relates to improving the sustainable development benefits of a CDM. One proposal[36] for doing this is the 'Gold Standard', which calls for enhanced environmental assessment, stakeholder consultations and the use of a qualitative sustainability matrix, expanding the CDM regime to allow programmes and policies to be credited – a concept elaborated on in a decision by the first meeting of the Kyoto Parties in 2005, and analysed by Ellis (2006) – and extending CDM project incentives beyond 2012.

Joint Implementation has been much less extensively researched than the CDM. Its later start date and unclear international rules (for example, the 'second track' rules were only agreed upon in October 2006) have generated considerable uncertainty with regard to implementation. Transactions under JI are seen as both cumbersome and beset with institutional obstacles (Korppoo, 2005). In addition, several authors have argued that JI projects will potentially be 'double counted' – given credit under both the project mechanism as well as under the rules for EU ETS. A number of proposals have been made to address this issue. Koch and Michaelowa (1999) and Moe *et al*. (2003) have suggested a 'Green Investment Scheme' (GIS) in which revenues from sales of Assigned Amount Units (AAU) are allocated to projects that reduce GHG emissions. Blyth and Baron (2003) suggest that the scale of a GIS in Russia could reach as much as € 1.25–3.5 billion per annum. This is a very approximate figure and depends on the balance of supply and demand and the prevailing allowance price. Fernandez and Michaelowa (2003) discuss the impact of defining the 'acquis communautaire' as the baseline for JI projects in the new EU Member States and stress the need to establish a predictable legal framework in the host countries, while Van der Gaast (2002) sees a reduced scope for JI in Eastern Europe due to the 'acquis' which could also be increased by using a GIS.

National institutions for project-based mechanisms have been slow to develop. The institutional problem is often exacerbated in countries with unstable economies and institutions and by project developers who often have very short time horizons, are unwilling to wait for the revenues and who cannot provide regular and ongoing monitoring and verification reports of emission reductions (see Michaelowa (2003a) for an overview of such issues in CDM host countries, Korppoo (2005) for specific issues related to the Russian Federation and Figueres (2004) for issues specific to Latin America).

Sectoral approaches

A number of researchers have suggested that sectoral approaches may provide an appropriate framework for post-Kyoto agreements (see sectoral approaches in Table 13.2). Under such a system, specified targets could be set, starting with specific sectors or industries that are particularly important, politically easier to address, globally homogeneous and/or relatively insulated from competition with other sectors. Such an approach may be binding (e.g. such as an agreement in the International Civil Aviation Organization) or voluntary (such as an agreement through the International Standardization Organization). Targets may be fixed or dynamic, and 'no-lose', binding or non-binding (Philibert and Pershing, 2001; Samaniego and Figures, 2002; Bodansky, 2004). Bosi and Ellis (2005) and Baron and Ellis (2006) have explored different design options for sectoral crediting, including policy, rate-based and fixed limit approaches, and Ellis and Baron (2005) have assessed how these options could be applied to the aluminium and electricity sectors.

Sectoral commitments have the advantage of being able to be specified on a narrower basis than total national emissions. Baumert *et al*. (2005b) consider specific options in aluminium, cement, iron and steel, transportation and electricity generation and conclude that while not all sectors are amenable to such approaches, considerable precedent already exists for agreement both between companies and by governments. Sectoral approaches provide an additional degree of policy flexibility and make the comparison of efforts between countries within a sector a relatively easy process – although comparing efforts across sectors may be difficult (see Philibert, 2005a). An additional disadvantage to sectoral approaches is that they may create economic inefficiency. Trading across all sectors will inherently be at a lower cost than trading only within a single sector.

13.3.3.4.3 Coordination/harmonization of policies

As an alternative to or complementary to internationally agreed caps on emissions, it has been proposed that countries agree to coordinated policies and measures that reduce the emission of GHGs. A number of policies that would achieve this goal have been discussed in the literature, including taxes (such as carbon or energy taxes), trade coordination/liberalization, R&D, sectoral policies and policies that modify foreign direct investment (FDI). Sectoral policies have been discussed above, R&D is discussed in Section 13.2.1.6 and FDI is discussed below on financing. This discussion focuses on harmonized taxes as well on as trade and other policies.

36 This is already being applied for some projects on a voluntary basis. See: http://www.cdmgoldstandard.org.

Box 13.7 Climate change and the World Trade Organization (WTO)

There is a history of international cooperation between environmental agreements and the WTO (see, for example, Frankel and Rose, 2003). However, there is also literature pointing to potential conflicts. To date, disputes between climate and trade agreements have not been legally tested. Should a complaint arise, the attitude of a WTO panel may depend on whether the disputed trade measure stems from a treaty obligation or a national policy. Neither the UNFCCC nor the Kyoto Protocol has been formulated in language that can reasonably be interpreted to require or authorize a trade measure as a strategy to promote membership, make the climate regime more effective or enforce the treaty. Thus, any use of a climate trade measure would be considered to be a national-level action (see Fischer *et al*., 2002).

Two examples help demonstrate the range of possible pitfalls:

- In 1998, Japan introduced the 'top-runner' programme as part of its domestic efforts to implement the Kyoto Protocol. This legislation was intended to ensure that automobiles and other manufactured products would be more energy efficient; it required new appliance and manufactured goods be as efficient as the 'top-runner' in the same category. The legislation raised concern among other automobile-exporting countries, most notably the USA and the EU, which feared that the measures might have adverse effects on their exports; consequently, the latter suggested that the legislation was not compatible with WTO rules on free trade. Conversely, according to Yamaguchi (2004), the Japanese legislation provides for objective standards that would be applied equally to domestic and imported cars and, accordingly, there would be no discriminatory treatment as a matter in law. After discussions between all parties over several years, no formal appeal was ever submitted under the General Agreement on Tariffs and Trade (GATT) or the Technical Barriers to Trade (TBT) Agreement (see Murase, 2004).
- Murase (2002b) considers potential conflicts between the use of the Kyoto Protocol's project-based flexibility mechanisms (CDM and JI) and various trade agreements. Inasmuch as project-based offsets represent foreign direct investment (FDI), they may run counter to both the GATT and Subsidies and Countervailing Measures Agreement as well as the common practice application of the Trade Related Investment Measures (TRIMs) and Agriculture Agreements. Adding an additional point of complexity, Werksman *et al*. (2001) suggest that the effective functioning of the CDM may require investor discrimination in a manner prohibited by the Most Favored Nation (MFN) clause of international investment agreements.

Assunção and Zhang (2002) explore other areas of interaction between domestic climate policies and the WTO, such as the setting of energy efficiency standards, the requirement for eco-labels and the implemention of targeted government procurement programmes. They suggest that an early process of consultation between WTO members and the Parties to the UNFCCC may be necessary to enhance synergies between the trade and climate regimes. To this end, they recommend the establishment of a joint WTO/Framework Convention on Climate Change (FCCC) working group that would specifically focus on greater coherence between trade, climate change and development policy.

One of the leading proponents of a harmonized tax has been Cooper (1998, 2001). Under his proposals, all participating nations – industrialized and developing alike – would tax their domestic carbon usage at a common rate, thereby achieving cost-effectiveness. Aldy *et al*. (2003) have suggested a number of problems with Cooper's proposals, including issues of fairness (whether developed and developing countries should have identical tax rates given the relative welfare and relative responsibilities), whether any incentive exists for developed countries to adopt a tax and how to manage gaming behaviour (in which a government may change tax codes to neutralize its effects or to benefit certain economic sectors). Additional criticism of a common tax structure comes from the modelling community: Babiker *et al*. (2003) note that while an equal marginal abatement cost across countries is economically efficient, it may not be politically feasible in the context of existing tax distortions. They also note that many countries which currently apply such taxes have exempted certain industries, thereby significantly increasing the overall costs of the tax regime. In addition, competitive concerns can arise if one country adopts a tax and a trading partner does not. Several solutions have been proposed, including the use of trade bans or tariffs to induce action. Governments may also seek to use border tax adjustments under such circumstances (Charnovitz, 2003). However, it has been argued that such a measure could be as disadvantageous to a target foreign country as a trade measure. To date, World Trade Organization (WTO) case law has not provided specific rulings on climate-related taxes. Any proposed border adjustments would need careful design and also take WTO law into account (Biermann and Brohm, 2005) (see Box 13.7).

The importance of harmonizing environmental standards – including those related to climate change – has been evaluated by Esty and Ivanova (2002), who conclude that both economic and ecological interdependence demand coordinated national policies and international collective action. To this end, they propose the creation of a Global Environmental Mechanism to help manage the environmental components of a globalizing world, primarily through information and analysis and the

creation of a policy space for environmental negotiation and bargaining.

Other fora, in addition to the WTO, also offer opportunities to exchange information and coordinate climate-related policies and activities. For example, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) offers an opportunity to unite efforts in a common cause to both protect endangered species and the climate. Similarly, meetings of Asia Pacific Economic Cooperation (APEC) provide a platform for regional economies to take steps that meaningfully address the adverse impact of climate change (Ivanova and Angeles, 2005). The APEC Virtual Center (APEC-VC) for region-wide Environmental Technology Exchange launched by the Asia-Pacific economies provides information on environmental technology gathered by regional and local governmental authorities as well as by companies and environment-related organizations. The North American Commission on Environmental Cooperation (the NACEC or CEC), which was created within the North America Free Trade agreement (NAFTA), offers another model: Canada, Mexico and the USA signed an agreement to cooperate on reducing the threat of global change. The trilateral agreement is the basis for public-private partnerships to reduce GHG emissions in North America and to boost investment in green technology. It should be acknowledged that the NACEC could not prevent the detrimental decline in the Mexican environment during their participation in NAFTA (Gallagher, 2004); therefore, some caution must be exercised with regard to the environment when engaging in trade agreements.

13.3.3.4.4 Technology

A number of issues related to technology research, development and deployment (including transfers and investment) have been explored in the literature on climate change. Many authors have asserted that a key element of a successful climate change agreement will be its ability to stimulate the development and transfer of technology – without which it may be difficult or impossible to achieve emissions reductions at a significant scale (Edmonds and Wise, 1999; Barrett, 2003; Pacala and Socolow, 2004).

Technology agreements

The studies reported in the literature make it very clear that R&D support, price signals and other arrangements can all contribute to technology development and diffusion. Financial and human resources, often scarce in developing countries, will be needed to promote R&D, while monetary and political incentives as well as institutional arrangements will be required to promote diffusion (see IPCC (2000) which contains a comprehensive review of technology transfer issues, including proposals for improving international agreements.) Technology agreements may also seek to address barriers in technology research, development and diffusion. (For additional details on specific sectors and technologies, see Chapters 4–10).

One variant of a technology agreement is formulated by Barrett (2001, 2003) in a proposal which emphasizes both common incentives for climate-friendly technology research and development (R&D) and technology protocols (common standards) rather than targets and timetables. While this proposal could potentially be environmentally effective, depending on the payoffs to the cooperative R&D efforts and the rate of technology deployment, Barrett notes that the system would neither be efficient nor cost-effective, not least because the technology standards would not apply to every sector of the global economy and may entail some technological lock-in. However, Barrett assumes that if standards are set in enough key countries, a 'tipping effect' is created which ultimately would lead to widespread global adoption. In reviewing Barrett's assessment, Philibert (2004) expresses doubts as to whether such a tipping effect would be applicable and suggests, alternatively, that for some technologies (e.g. CO_2 capture and storage), cost constraints may be more critical than acceptability in determining market penetration.

The concept of regional technology-specific agreements has also been explored by Sugiyama and Sinton (2005), who suggest that they may offer an interim path to promote cooperation and develop new, lower cost options to mitigation climate change – allowing any future negotiations on emission caps to proceed more smoothly. Box 13.8 lists some examples of existing international technology coordination programmes.

Technology transfer

One mechanism for technology transfer is through the establishment of – and subsequent contributions to – special funding agencies that disburse money to finance emissions reduction projects or adaptation activities. The UNFCCC and the Kyoto Protocol already include provisions for establishing and funding project activities, although contributions to and participation in these are mostly voluntary. UNFCCC also includes provisions for technology transfer under Article 4.5. The CDM could also be a vehicle for technology transfer, but the effects are unclear at this point.

As part of the Marrakesh Accords, at the seventh Conference of the Parties (COP 7), Parties were able to reach an agreement to work together on a set of technology transfer activities, which were grouped under a framework for meaningful and effective actions to enhance the implementation of Article 4.5 of the Convention. This framework[37] has five main themes:

1. Technology needs and needs assessments;
2. Technology information;
3. Enabling environments;
4. Capacity building;
5. Mechanisms for technology transfer.

37 See UNFCCC decision 4/COP 7 on the Development and Transfer of Technologies

Box 13.8 Examples of coordinated international R&D and technology promotion activities

- **International Partnership for a Hydrogen Economy:** Announced in April 2003, the partnership consists of 15 countries and the EU, working together to advance the global transition to the hydrogen economy, with the goal of making fuel cell vehicles commercially available by 2020. The Partnership will work to advance the research, development and deployment of hydrogen and fuel cell technologies and to develop common codes and standards for hydrogen use. See: www.iphe.net.
- **Carbon Sequestration Leadership Forum:** This international partnership was initiated in 2003 and has the aim of advancing technologies for pollution-free and GHG -free coal-fired power plants that can also produce hydrogen for transportation and electricity generation. See: www.cslforum.org.
- **Generation IV International Forum:** This is a multilateral partnership fostering international cooperation in research and development for the next generation of safer, more affordable and more proliferation-resistant nuclear energy systems. This new generation of nuclear power plants could produce electricity and hydrogen with substantially less waste and without emitting any air pollutants or GHG emissions. See: http://nuclear.energy.gov/genIV/neGenIV1.html.
- **Renewable Energy and Energy Efficiency Partnership:** Formed at the World Summit on Sustainable Development in Johannesburg, South Africa, in August 2002, the partnership seeks to accelerate and expand the global market for renewable energy and energy-efficiency technologies. See : http://www.reeep.org
- **Asia-Pacific Partnership on Clean Development and Climate:** Inaugurated in January 2006, the aim of this partnership between Australia, China, India, Japan, Republic of Korea and USA is to focus on technology development related to climate change, energy security and air pollution. Eight public/private task forces are to consider (1) fossil energy, (2) renewable energy and distributed generation, (3) power generation and transmission, (4) steel, (5) aluminium, (6) cement, (7) coal mining and (8) buildings and appliances. See: http://www.asiapacificpartnership.org.

Actions to implement the framework include the organization of meetings and workshops, the development of methodologies to undertake technology needs assessment plans, the development of a technology transfer information clearinghouse, including a network of technology information centres, actions by governments to create enabling environments that will improve the effectiveness of the transfer of environmentally sound technologies and capacity building activities for the enhancement of technology transfer under the Convention. Funding for technology needs assessments has been provided, and further funds for technology may become available from the UNFCCC's Special Climate Change Fund.

Other international efforts have also been undertaken to promote technology transfer in support of climate change mitigation efforts, including those by the UN Industrial Development Organization (UNIDO) and by the Climate Technology Initiative (CTI) of the IEA. As noted by the US National Research Council, additional work is particularly needed to assist poor countries as these lack scientific resources and economic infrastructure as well as the appropriate technologies to reduce their vulnerabilities to potential climate changes (NRC, 2003).

The distinction between public financing for climate change mitigation and private financing for technology investment is often blurred: Clean energy projects are frequently a blend of the two, with public financing used to leverage private investment. For example, the International Finance Corporation (IFC) clean energy financing projects in Eastern Europe, Russia, China and the Philippines use technical assistance funds to train commercial banks in energy efficiency while concurrently lending partial risk guarantees and offering credit lines to encourage banks to provide loans. In this manner public funds are heavily leveraged and provide a source financing for clean energy investments.[38]

Development oriented actions

A 'Sustainable Development Policies and Measures' (SDPAMS) approach proposed by Winkler *et al*. (2002b) and further elaborated by Bradley *et al*. (2005) focuses on linking climate mitigation and adaptation to priority development needs. In its standard form, such an approach would be domestic and unilateral and – with its focus on developmental needs – would also bring GHG benefits. However, the authors also suggest that simultaneous SDPAMS pledges (and possibly harmonized pledges) could be made by both developing and developed countries. However, Bradley *et al*. (2005) do note several limits to this approach and suggest that it may not be suitable for developed countries, nor for every technology or policy. Finally, they note that SDPAMS may not attract the necessary funding for it to be implemented on the scale required for global climate change mitigation.

13.3.3.5 Financing

Funding sources for GHG mitigation in developed and developing countries is a crucial issue in the international debate on tackling climate change. Financing is categorized in the literature in terms of public flows (including Development

38 See www.ifc.org/CEEF.

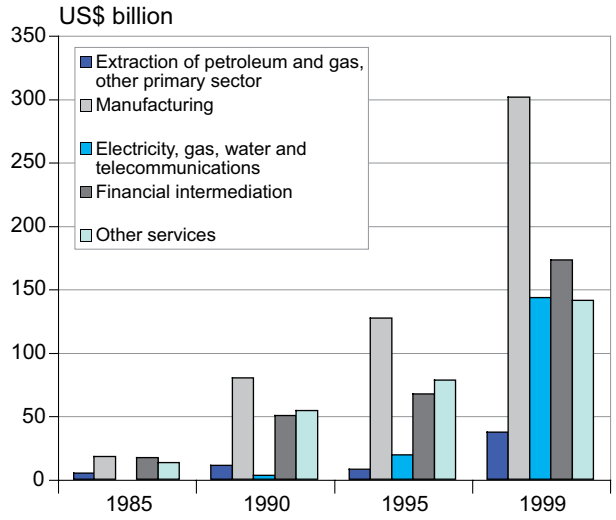


Figure 13.5: *Total OECD foreign direct investment (FDI) outflows to selected sectors.*

Source: OECD (1999)

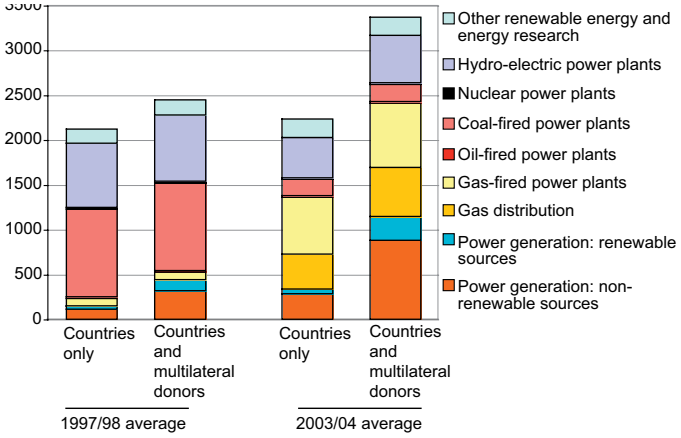


Figure 13.6: *Development assistance for energy*

Source: OECD.

Assistance and government loan guarantees through export credit agencies), private flows or foreign direct investment (FDI) and financing from multilateral institutions, including the Global Environment Facility (GEF) and international financial institutions. Public financing is the main form of assistance for developing country climate change mitigation, while the private sector provides the technology investments. CDM resources are significant when compared with GEF funding, but small in comparison to FDI resources (Ellis *et al*., 2007). In addition to these instruments, a World Bank survey of contingent financing and risk mitigation instruments for clean infrastructure projects describes the characteristics and potential use of other instruments, such as insurance, reinsurance, loan guarantees, leases and credit derivatives[39] (IPCC, 2000; World Bank, 2003). A small percentage of public funds are used to leverage private investment in clean energy projects.

13.3.3.5.1 Foreign direct investments

OECD trade and FDI have grown strongly in relation to GDP during the past decade: cumulative net FDI outflows between 1995 and 2005 amounted to 1.02 trillion US$. As a share of GDP, outward FDI grew from 1.15% of the GDP in 1994 to 2.02% in 2004. However, while the total sums grew, only 35% went to non-Annex I countries – and of that, nearly 70% went to five countries, namely China (including Hong Kong), Brazil, Mexico, Singapore and South Korea.[40] See also OECD (2005 d) for trends in FDI relative to ODA.

One common assertion in international environmental negotiations is that FDI promotes sustainable development as multinational corporations (MNCs) transfer both cleaner technology and better environmental management practices. However, empirical studies find little evidence that MNCs transfer either significant cleaner technology or better practices. In statistical studies of Mexico (manufacturing) and Asia (pulp and paper), foreign firms and plants performed no better than domestic companies (Zarsky and Gallagher, 2003). According to Jordaan (2004) the externalities from the presence of foreign-owned firms do not occur automatically, but are dependant on underlying characteristics of the industries and manufacturing firms.

Most FDI in developing countries is targeted to activities such as the extraction of oil and gas, manufacturing and electricity, gas and water, which have the aim to improve economic development but also to increase GHG emissions (Figure 13.5). Maurer and Bhandari (2000) report that during the mid- to late-1990s the major developed countries co-financed energy-intensive projects and exports valued at over 103 billion US$ through their export credit agencies (ECAs). These projects and exports included oil and gas development, fossil fuel power generation, energy-intensive manufacturing, transportation infrastructure and civilian aircraft sales. These countries accounted for 90% of the co-financing provided by ECAs to these energy-intensive exports and projects. By comparison, industrialized countries have directed just a fraction of their ECA financing to renewable energy projects. Between 1994 and 1999 ECAs supported a total of 2 billion US$ in renewable energy projects.

13.3.3.5.2 Direct international transfers

Official development assistance (ODA) remains an important source of financing for those parts of the world and sectors

39 See the website of the World Bank carbon finance unit for additional information on financial instruments: http://carbonfinance.org.
40 See UNCTAD, Foreign Direct Investment Database: http://www.unctad.org/Templates/Page.asp?intItemID=1923&lang=1.

where private flows are comparatively low, although this is a modest financial resource relative to global private direct investment, which was 106 billion US$ in 2005. Data from the OECD suggest that development assistance for energy projects (approximately 3.2 billion US$ in 2004) from bilateral sources has remained relatively flat over the last 6 years.. There has been a shift in support away from coal technologies to those of gas and some extent renewables[41] (see Figure 13.6).

The effectiveness of ODA depends on various factors, the most important of which are good governance, policy and institutional frameworks that encourage private investment (macroeconomic and political stability, respect for human rights and the rule of law), minimum levels of investment in human capital (education, good health, nutrition, social safety nets) and policies and institutions for sound environmental management.

13.3.3.5.3 GEF and the multilateral development banks (MDBs)

The GEF, established in 1991, provides support to developing countries for projects and programmes that protect the global environment. Jointly implemented by the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP) and the World Bank, GEF provides grants to fund projects related to biodiversity, climate change, international waters, land degradation, the ozone layer and persistent organic pollutants.[42]

Compared to the magnitude of the environmental challenges facing recipient countries, GEF efforts are relatively modest in scope. From 1991 to 2004, GEF allocated 1.74 billion US$ to climate change projects and activities; even when this amount is matched by the more than 9.29 billion US$ in co-financing, the overall scale of the GEF is small.[43] Funding is given to five project types, namely renewable energy, energy efficiency, sustainable transportation, adaptation, low GHG energy technologies and enabling activities. Hall (2002) analysed the GEF portfolio and noted the focus on incremental, one-time investments in mitigation projects that test and demonstrate a variety of financing and institutional models for promoting technology diffusion. He suggests that this approach should help contribute to a host country's ability to understand, absorb and diffuse technologies.

According to a review of the GEF by the World Bank (2006), 'the GEF's track record in reducing the long-term cost of new low GHG-emitting technologies has not been encouraging'. The continued effectiveness of GEF project funding for technology project types will depend on factors such as the duplication of successful technology transfer models, enhanced links with multilateral banks and co-ordination with other activities that support national systems of innovation and international technology partnerships. It has been suggested that GEF reform will be needed to enhance its effectiveness and transparency, particularly with respect to determining contributions and for evaluating priorities for disbursements (Grafton *et al*., 2004).

The World Bank (2004a) review of its investments in extractive industries determined that in the future it would be more selective, with a greater focus on the needs of poor people and a stronger emphasis on good governance and on the promotion of environmentally and socially sustainable development. The IFC has revised its performance standards in 2006 to require the reporting of GHG emissions for projects with both direct and indirect emissions of greater than 100,000 tonnes annually. The standards also require the consideration of alternatives or improvements to the energy efficiency of energy intensive projects (see http://www.ifc.org/ifcext/enviro.nsf/Content/ENvSocStandards). However, Sohn *et al*. (2005) note that the World Bank has continued to both support traditional CO_2-intensive fossil fuels projects and provide relatively limited resources to renewable and low CO_2-emitting energy alternatives. They suggest that Governments may use their leverage to direct the activities of multilateral development banks through their respective Boards and Councils in order to strengthen MDB programmes to account for the environmental consequences of their lending; develop programmatic approaches to lending that remove institutional barriers and create enabling environments for private technology transfers.

The higher perceived risk in developing countries, as reflected in sovereign credit ratings, can be compounded further by including new and emerging technologies. International or regional financing institutions can play a critical role in lowering the risk and leveraging private finance into the sector. MDBs have responded to this challenge by establishing several new initiatives. For example, the European Bank for Reconstruction and Development's (EBRD) new Sustainable Energy Initiative was launched in May 2006 to address the wasteful and polluting use of energy. The EBRD plans to invest up to € 1.5 billion in energy efficiency, renewables and clean energy projects over the next 3 years, which could lead to up to € 5 billion of total investment. The Asian Development Bank (ADB) launched the Energy Efficiency Initiative (EEI) in July 2005, the core objective of which is to expand ADB's investments in energy efficiency projects (including renewable energy), with an indicative annual lending target of 1 billion US$ between 2008 and 2010. The World Bank has announced the establishment of the Clean Energy Fund Vehicle with a capitalization of 10 billion US$ and an annual disbursement of 2 billion US$ to accelerate the transition to a low carbon economy.

41 See OECD website for information on development activities, including statistics, data, indicators and methods for accessing data: http://www.oecd.org/topicstatsportal/0,2647,en_2825_495602_1_1_1_1_1,00.html
42 See the website of the Global Environment Facility for additional information: http://www.gefweb.org/
43 http://www.gefweb.org/Projects/focal_areas/focal_areas.html#cc

13.3.3.6 Capacity building

The literature on climate change has not addressed capacity building to any extent, despite its critical relevance to the climate change issue. Part of the solution to the climate change problem has been cast in terms of helping developing countries with technology transfer and assistance. The importance of this is recognized in the text of the UNFCCC and Kyoto Protocol as well as in the more detailed implementing framework of the Marrakech Accords.

The capacity building framework within the climate change regime focuses on developing the capacity in developing countries to implement decisions. Capacity building has been defined historically as the formal training of employees, technological gate-keeping and learning-by-doing, with the recognition that this is a slow and complex process. According to Yamin and Depledge (2004), the Marrakesh Accords have been partially successful in bringing some additional coherence, coordination and prioritization into the process of capacity building. These authors argue that the effort to promote country-driven and contextually tailored efforts that are both iterative and involve learning-by-doing are appropriate.

Other ideas on capacity building also abound. Sagar (2000) argues that it may be more relevant to strengthen the domestic capacity for undertaking policy research and innovation as well as for managing technological and institutional change rather than merely creating the capacity for implementing policies developed elsewhere. This proposal is based on the idea that only context-relevant policy instruments are likely to work within the specific domestic circumstances of the relevant countries.

A number of recent analyses carried out on this subject have questioned whether capacity building can be initiated from outside a country. Since capacity issues are embedded in local contexts, the OECD has argued that it may be a mistake to assume that capacity building can be easily accomplished from outside this context.

Najam *et al*. (2003) note the importance of capacity building for developing countries and require that it be an integral part of any future agreement if it is to have wide support from this group. In particular, they argue that inasmuch as efforts to combat climate change and promote sustainable development are 'two sides of the same coin' enhancing the capacities of communities and countries to fight climate change will have multiple benefits. They also make the case that the most pressing need in this context is to strengthen the social, economic and technical resilience of the poorest and most vulnerable countries against extreme climatic events.

13.3.3.7 Compliance

Using game theory, Hovi and Areklett (2004) argue that a compliance system has to meet several criteria: (1) consequences of non-compliance have to be more than proportionate; (2) punishment needs to take place when behaviour is suboptimal; (3) an effective enforcement system must be able to curb collective as well as individual incentives to cheat. The compliance system agreed under Kyoto is viewed as only partially fulfilling these criteria. For example, Nentjes and Klaassen (2004) note that the obligation to fully restore any excess emissions in subsequent periods does not exclude the option of postponing restoration forever. If such an outcome occurs, the trading mechanisms under the Protocol may be substantially weakened. However, it is pointed out that introducing adversarial elements (such as sanctions) into the system are highly undesirable in view of the fact that the Kyoto Protocol currently covers only one third of the total GHG emissions of the world (Murase, 2005).

There are two schools of thought regarding the appropriate response to non-compliance contemplated under the Kyoto Protocol (see Murase, 2002b). One view advocates 'soft' compliance-management, which favours primarily facilitative and promotional approaches by rendering assistance to non-compliant States; those holding this view often refer to 'the non-compliance procedure' used under the Montreal Protocol. The other view takes a 'hard' enforcement approach in order to coerce compliance by imposing penalties or sanctions on non-complying parties. Financial penalties and economic or trade sanctions have been proposed along these lines. However, it has been suggested that such measures could be in conflict with WTO/GATT rules on trade liberalization (Mitchell, 2005).

A more nuanced view is provided by Wettestad (2005), who concludes that there are eight lessons to be learnt from other regimes. These include the need for an institutional warm-up period, wise institutional engineering, moderate expectations from the verification process, increased transparency, efforts to maintain close cooperation between the Facilitative and Enforcement Branch of the Compliance Committee, the search for opportunities to engage civil society in the process and a focus on assistance and compliance facilitation using the enforcement mechanism as an important but 'hidden' stick.

In his review of the Kyoto Protocol's compliance mechanism, Barrett (2003) argues that failure to comply over two compliance periods can essentially be equivalent to indefinitely postponing action: A country that is found in non-compliance in the first period has to make up the difference plus 30% in the next period. If it fails to achieve the latter target as well, it will have to make up the difference in the period thereafter – a process that can continue indefinitely. Perhaps the most important point in his proposal is that if countries feel that they cannot easily meet their commitments, they will negotiate for higher allowances in the period thereafter – or even withdraw from the agreement entirely. He also notes that the Protocol does not have any procedures to deal with countries that decide not to cooperate with the rules.

There is a significant body of research that compares various dispute settlement procedures. A number of these assessments examine environmental agreements (see, for example, Werksman, 2005), while others more specifically focus on possible conflicts between climate agreements and trade agreements (see, for example, Murase, 2002b). With respect to the latter, Murase notes the need for a coordinating authority to be established between a multilateral environmental agreement (MEA) and the WTO. Given that MEAs and the WTO are independent treaties on equal footing, neither can automatically be given the right to make a decision in the case of a conflict. As a result, a number of authors (e.g. Esty, 2001; Murase, 2002b) have called for the establishment of a new institution, such as a World Environment Organization (WEO), that would embody its own dispute settlement mechanism. This institution would function as a counterpart of WTO by attaining an equal footing between the two regimes.

13.3.3.8 Adaptation

The element of adaptation in international climate agreements has been far less explored to date than mitigation.[44] While most authors agree that adaptation is a vital part of a future agreement (although Schipper (2006) suggests that it was not a key focus of the initial UNFCCC negotiators), there is little mention in climate change literature of concrete proposals detailing the actions or obligations that should be undertaken by countries. Most proposals focus on leveraging funding for adaptation activities with an additional set of proposals addressing more specifically the links between adaptation, vulnerability and development agendas (see, for example, Najam *et al*., 2003).

Parry *et al*. (2005) develop an assessment of how adaptation may be incorporated into a future climate change architecture. They begin by noting that much of the adaptive response is likely to be local and, consequently, it is less conducive to a common international approach. Instead, they argue that a key need will be for efforts to incorporate adaptation into development policies and practices, including local, sectoral and national decision-making – a process they refer to as 'climate-proofing'. At the local level, this would incorporate strategies for municipal planning, including developing and maintaining seed banks, emergency preparedness services and community social services. At the sectoral level, it would include efforts to build climate into infrastructure design and maintenance codes and standards. At the national level, it would include integration into national planning and budget processes – for example, by examining whether planned expenditures will increase exposure to the impacts of climate change – and by doing so, minimize the financial risk, promote macro-economic stability and set aside sufficient funds to manage the consequences of climate shocks. Finally, at the international level, they suggest that key opportunities exist for integrating adaptation into the Millennium Development Goals and into lending practices of international institutions and bilateral aid agencies.

Three funds have been created under the UNFCCC and the Kyoto Protocol to manage adaptation issues: the Least Developed Countries Fund, the Special Climate Change Fund (both under the UNFCCC) and the Adaptation Fund (under the Protocol). In addition, the GEF has been requested to consider adopting more flexible approaches to funding adaptation (though this may not happen with core GEF funds, but with new money from these other funds that would be disbursed by the GEF).

Corfee-Morlot *et al*. (2002) suggest that it would be unrealistic to expect the GEF to cover the full cost of adaptation as such expenses would quickly exhaust their resources. Huq and Burton (2003) propose integrating adaptation into the mainstream work of development agencies, thereby allowing for more cost-effective and wider ranging support. However, as noted by Huq and Reid (2004), doing so runs the risk of diluting other existing aid efforts – which often have considerably higher priorities in-country than climate change adaptation.

The potential role for private (and public) insurance has also been suggested as a possible mechanism to pay for adaptation (e.g. Bals *et al*., 2005). Parry *et al*. (2005) list possible insurance schemes and risk transfer instruments, including:

- An international insurance pool (a collective loss-sharing fund to compensate victims of climate change damages);
- Public-private insurance partnerships (where the insurer is the government, but policies are developed and managed by the private sector);
- Regional catastrophic insurance schemes (regional cash reserves are pooled through mandatory contributions from member governments, and reserves are used for weather-related catastrophes);
- Micro-insurance (risk pooling for low-income individuals affected by specific risks);
- Catastrophe bonds (giving private insurers protection against extreme events; capital is provided by large institutional investors);
- Weather derivatives (financial mechanisms to hedge financial risk from catastrophic weather events)
- Weather hedges (providing protection for farmers; currently sold by banks, farm cooperatives and micro-finance institutions).

13.3.3.9 Negotiating process

It is important that several technical issues be taken into consideration when an agreement is negotiated and implemented. Since the international negotiation process under the UNFCCC is based on decisions by consensus, an approach

44 See IPCC(2007b), Chapter 17 and 18 for a broad review of adaptation issues.

Table 13.3: *Assessment of international agreements on climate change.*[45]

Approach	Environmental effectiveness	Cost-effectiveness	Meets distributional considerations	Institutional feasibility
National emission targets and international emission trading (including offsets)	Depends on participation and compliance.	Decreases with limited participation and reduced gas and sector coverage.	Depends on initial allocation.	Depends on capacity to prepare inventories and compliance. Defections weaken regime stability.
Sectoral agreements	Not all sectors amenable to such agreements, thereby limiting overall effectiveness. Effectivenss depends on whether agreement is binding or non-binding.	Lack of trading across sectors increases overall costs, although they may be cost-effective within individual sectors. Competitive concerns reduced within each sector.	Depends on participation. Within-sector competitiveness concerns are alleviated if treated equally at global level.	Requires many separate decisions and technical capacity. Each sector may require cross-country institutions to manage agreements.
Coordinated policies and measures	Individual measures can be effective; emission levels may be uncertain; success will be a function of compliance.	Depends on policy design.	Extent of coordination could limit national flexibility, but may increase equity.	Depends on the number of countries (easier among smaller groups of countries than at the global level).
Cooperation on Technology RD&D[a]	Depends on funding, when technologies are developed and policies for diffusion.	Varies with degree of R&D risk. Cooperation reduces individual national risk.	Intellectual property concerns may negate the benefits of cooperation.	Requires many separate decisions. Depends on research capacity and long-term funding.
Development-oriented actions	Depends on national policies and design to create synergies.	Depends on the extent of synergies with other development objectives.	Depends on distributional effects of development policies.	Depends on priority given to sustainable development in national policies and goals of national institutions.
Financial mechanisms	Depends on funding selection criteria.	Depends on country and project type.	Depends on project and country.	Depends on national institutions.
Capacity building	Varies over time and depends on critical mass.	Depends on programme design.	Depends on selection of recipient group.	Depends on country and institutional frameworks.

[a] Research, Development and Demonstration.

that is simple and requires a small number of separate decisions by international bodies most likely has a higher chance of being agreed upon. This may be true of any agreement that engages multiple countries.

It has been reported in the literature that ownership of an instrument – and hence its commitment and effectiveness – is linked to the manner in which the agreement was negotiated, and that the leadership (directional, instrumental and structural) demonstrated in a regime may stimulate its effectiveness. Kanie (2003) concludes that in the EU, the introduction of policies and measures and institution building changed the dynamics of the climate change negotiation process by enhancing leadership capacity.

The role and influence of non-State actors in the process of negotiation also increase the legitimacy and compliance-pull of a regime, both because such participation promotes the broader acceptability of the agreement and because it may increase knowledge about the regime. Agreements are also more likely to be effective when they are negotiated in accordance with established rules of procedure, when the negotiators of key countries have been able to adequately prepare themselves for the negotiation and when the subject matter of the negotiations is designed to address the problem and has not been artificially limited to make the solutions more attractive to the more powerful countries (Andresen and Wettestad, 1992; Benedick, 1993; Sebenius, 1993; Greene, 1996; Gupta and Grubb, 2000; Gupta and Ringius, 2001). The attention of the regular media to climate negotiations can also mobilize awareness of the issue which then increases pressure on the negotiators to achieve a result (Newell, 2000).

13.3.4 Evaluating international climate change agreements

This section reviews the literature using the same criteria as in Section 13.2: environmental effectiveness, cost-effectiveness, distributional considerations and institutional feasibility. The discussion is summarized in Table 13.3, and then discussed in

45 The table examines each approach based on its capacity to meet its internal goals – not in relation to achieving a global environmental goal. If such targets are to be achieved, a combination of instruments needs to be adopted. Not all approaches have received an equivalent evaluation in the literature; evidence for individual elements of the matrix varies.

greater depth in the text. As is the case with national policies, international agreements are instruments that can be designed well or poorly and be stringent or lax, binding or non-binding, or politically attractive or unattractive.

13.3.4.1 Environmental effectiveness

Environmentally effective international agreements lead to reductions in global GHG emissions and/or concentrations or to decreased climate impacts. The literature suggests that to achieve such success, agreements must provide incentives or deterrents to both State and individual behaviour in order to achieve a specific outcome. However, at the international level, there is some dispute as to whether agreements change trends, or merely codify actions already underway.

An additional critical element in the effectiveness of an international agreement is that of the implementation context: The relevant literature shows that agreements tend to be more successful in countries with both a high level of domestic awareness and resources and a strong institutional and legal framework and where there is clear political will. Where global agreements are designed using only blue-print approaches to instruments, these instruments may ultimately ignore the specific cultural and institutional contexts within which they are designed to function and may actually not work as well (see conclusions of the Millennium Ecosystem Assessment, 2005). Agreements that promote ancillary objectives, such as reductions in ordinary air pollution levels, also have a higher chance of success.

An agreement that includes a limited group of countries (particularly if they are not major emitters) may be less effective – and this weakness may be exaggerated when emissions of non-participating countries increase by the migration of emission-intensive industries. Conversely, additional benefits may accrue due to technology spillover that may enhance environmental effectiveness (see Section 13.3.3.2).

The timing of an agreement's provisions may also affect its effectiveness: Focusing only on longer term emission reductions (as suggested under some forms of technology agreements) may preclude the possibility of reaching low climate stabilization levels, as many lower levels require immediate emission reductions.

13.3.4.2 Cost-effectiveness

A cost-effective international agreement would minimize global and national costs and provide participating sovereign nations with sufficient flexibility to reach their commitments in a fashion tailored to their national needs and priorities. To achieve this, agreements would need to avoid being prescriptive in its actions but, instead, leave room for the implementation of the target, (e.g. while reducing emissions in different sectors or reducing the emissions of different gases, they should not create significant distortions in competitiveness between countries).

Many analysts argue that the most cost-effect system would be one which enables emission trading with the broadest possible participation of countries. Such a system would allow the emission reductions to occur in those countries, sectors and gases where they can be achieved at the lowest cost. An approach based on specific policies and measures would have to be designed carefully to be as efficient as an emission trading system. The flexibility provided to private actors in a trading regime also increases the system's cost-effectiveness.

13.3.4.3 Distributional considerations, including equity

Perhaps the most politically charged issue in international negotiations is that of equity. Whether a system of national emission targets within an international agreement can be conducive to social development and equity depends on participation and the initial allocation of emission rights. For example, Pan (2005) suggests that all countries should participate – but that emissions associated with basic needs should be exempt from limits, while emissions associated with luxury activities should be constrained. Conversely, Gupta and Bhandari (2003) suggest that in the initial stages of an agreement, obligations should only be assigned to a limited set of (wealthier) parties. Exemptions to sectors or countries and modifications to the allocation of obligations can help address equity issues.

13.3.4.4 Institutional feasibility

Two aspects of institutional feasibility are critical in reaching successful international agreements: (1) negotiating and adopting an agreement and (2) the subsequent (usually national) implementation of that agreement.

Since international agreements are usually adopted by consensus, successful agreements are often relatively simple and require only a limited number of separate decisions by international bodies. In addition, global agreements usually require that all data and tools necessary for enforcement be widely available and verifiable (or if not, that they become available in the future). While there has been no comprehensive critique of the proposals in Table 13.3 in terms of their institutional feasibility, the latter clearly varies widely – for example, in terms of the extent to which they try to accommodate national circumstances and different levels of technical sophistication. Hence, the feasibility of reaching agreements will also vary accordingly.

A sectoral or technology approach would require multiple decisions: which sectors, which types of technologies, and how to regulate or support them. Choosing the sectors (and determining sectoral boundaries) or technologies for agreement may be difficult – unless participation were voluntary (e.g. the current suite of IEA implementing agreements, or the bilateral and multilateral efforts on specific technologies). This may require compromises on environmental effectiveness and equity. In addition, the assessment of whether a country had

fulfilled its obligations would be complex. Philibert (2005a) notes that determining the effectiveness of technology or sectoral agreements could be difficult. In the case of a technology approach, definitive conclusions would likely be delayed until the technologies began to diffuse – and that could mean concomitant requirements for establishing long-lived institutions. The establishment of international institutions to manage coordinated policies and measures or development-oriented approaches may also be complex. While some private sector international institutions exist (e.g., the Aluminium Institute, which has set targets for GHG reductions in aluminium processing among its member companies), most sectors do not have such institutional arrangements. Similarly, while there are institutions designed to promote development (e.g., the Bretton Woods institutions), few have integrated climate change into their portfolios (see Maurer and Bhandari, 2000). Kanie (2006) argues that while the Kyoto Protocol will remain the core of the institutional system, a network will ultimately be both necessary – and increase effectiveness. The creation of a web of institutions tackling climate change and related issues not only ensures that any shortcoming in one institution does not lead to the collapse of the whole system, but it also enhances collective strength.

13.4 Insights from and interactions with private, local and non-governmental initiatives

This section addresses voluntary actions taken by sub-national governments, corporations, NGO's and others that are independent of national government programs or policies. See Box 13.9. Note that in contrast, section 13.2 addresses voluntary agreements between national governments and private parties.[46]

13.4.1 Sub-national initiatives

Local, state, provincial or regional governments have developed GHG policies and programmes that are either synergistic with national policies or are independent of these policies. Several reasons are given in the literature as to why sub-national entities undertake independent policies on GHGs or other environmental issues. Oates (2001) and Vogel *et al*. (2005) highlight the influence that State governments in the USA have had on national policy by experimenting with innovative initiatives. Rabe (2004) argues that some US states have enacted GHG policies to create incentives for new emission reduction technologies or to facilitate the recognition of emission reductions by companies in the event of future national regulations. Regional or local GHG reductions may also be motivated by the desire to achieve additional environmental co-benefits, such as reductions in air pollution.

On the other hand, sub-national actions to address climate change may be viewed as a 'free rider' problem because non-participating regions may benefit from the actions of the participating areas without paying the costs (Kousky and Schneider, 2003). Regional or local initiatives may also cause 'leakage' if mandatory requirements in one jurisdiction cause a shift in economic activity and emissions to other jurisdictions without mandatory requirements (Kruger, 2006).

Sub-national governments in the USA and Australia, two countries that are not Parties to the Kyoto Protocol, have been among the most active on GHG policy, with a number of US states having adopted or proposed a variety of programmes to address GHGs, including renewable energy portfolio standards, energy efficiency programmes, automobile emissions standards and emissions registries. Perhaps the most notable examples of such an initiative are those of eight states in north-eastern and mid-Atlantic USA announcing their intent to adopt a regional cap-and-trade programme, known as the Regional Greenhouse Gas Initiative (RGGI); three western states – California, Washington and Oregon – may explore a similar initiative (McKinstry, 2004; Peterson, 2004; Pew Center, 2004; Rabe, 2004). Australian states have developed a broad array of programmes to reduce, sequester or measure GHG emissions (see http://www.epa.qld.gov.au/environmental_management/sustainability/greenhouse/greenhouse_policy/other_states_and_territories/). For example, the Australian state of Victoria has adopted a series of programmes to support renewable energy projects and the development of a 'green power' market (Northrop, 2004), while that of New South Wales has developed a credit-based emissions trading scheme for electricity retailers, generators and some electricity users. (Fowler, 2004; Baron and Philibert, 2005; MacGill, *et al*., 2006). Finally, the Australian states have announced their intention to explore the development of a multi-jurisdictional emissions trading system (see http://www.cabinet. nsw.gov. au/ greenhouse/report.pdf).

Northrop (2004) reports that more than 600 cities worldwide have participated in programmes to implement measures aimed at reducing local GHG emissions.[47] These include cities in developing countries. In total, 18 cities in South America,[48] 12 cities in South Africa[49] and 17 cities in India[50] are becoming more active in developing environmental measures at the local level. Kousky and Schneider (2003) find that cities have primarily adopted GHG policies with co-benefits, including more efficient energy use. Fleming and Webber (2004) describe a variety of GHG measurement and energy efficiency measures undertaken at the regional and local level in the UK, and Pizer and

46 See Higley *et al*. (2001), OECD (2003e) and Lyon and Maxwell (2004) for typologies of different types of approaches and initiatives.
47 These cities participate in the International Council for Local Environmental Initiatives (ICLEI), Cities for Climate Protection (CCP) programme. See http://www.iclei.org.
48 http://www.iclei.org/index.php?id=528.
49 http://www.iclei.org/index.php?id=700.
50 http://www.iclei.org/index.php?id=1089.

Tamura (2004) summarize measures undertaken by the Tokyo city government to reduce GHGs and control the 'heat island' effect. These types of initiatives may influence sub-national and national government policies and serve as incubators for new approaches to achieve GHG emission reductions.

13.4.2 Corporate and NGO actions

Corporations and NGOs, including industry associations and environmental advocacy groups, have started a variety of programmes and initiatives to address GHG emissions. The various factors leading corporations to adopt voluntary environmental action have been explored in the literature (Lyon and Maxwell, 2004; Thalmann and Baranzini, 2005). While some companies have attributed these actions to sustainable development goals or environmental stewardship policies (Margolick and Russell, 2001), it is often difficult to separate these goals from economic motives (Kolk and Pinske, 2004). Less controversial is the notion that companies adopt voluntary initiatives to create financial value in one form or another (Lyon and Maxwell, 2004).

There are both political and non-political drivers of corporate voluntary environmental action. Political drivers include a desire to pre-empt or influence future regulation. For example, trade associations in 30 countries have sponsored codes of management practices, the objectives of which are partly intended to forestall the imposition of government mandates (Nash and Ehrenfeld, 1996). Alternatively, corporations may adopt voluntary initiatives to influence future regulation in ways that improve their strategic positions. By adopting environmental technologies or other strategies ahead of regulatory mandates, corporations can signal to regulators that these alternatives are practical or relatively cost-effective (Reinhardt, 1999). Hoffman (2005) finds that some companies have adopted internal emissions trading schemes or GHG measurement programmes to gain expertise that will help them influence future national or international policies. A related motivation for voluntary action is the desire to manage the risks of future regulations by taking action that would increase profitability or protect a company's competitive position in the event of future regulatory mandates (Margolick and Russell, 2001).

Non-political drivers of voluntary corporate environmentalism include the desire to reduce costs through practices that also have environmental benefits (sometimes known as 'eco-efficiency'). Esty and Porter (1998) discuss how the desire to reduce energy or material costs drives corporate voluntary action, although this point of view is subject to some debate (Palmer *et al*., 1995; Porter and van der Linde, 1995). Hoffman (2005) and Margolick and Russell (2001) describe a variety of actions taken by US and Canadian companies to reduce GHG emissions while also reducing energy and operational costs.

Companies may also adopt environmental initiatives to appeal to green consumers, environmentally conscious stakeholders or even their own employees. Reinhardt (1998) discusses how this approach can take the form of companies differentiating their products by their environmental performance. Other companies have identified market opportunities for new products from potential GHG gas regimes (Reinhardt and Packard, 2001; Kolk and Pinske, 2005). In terms of the composition of the stakeholders, Maxwell *et al*. (2000) find that firms located in US states with a higher per capita membership in environmental organizations had more rapid reductions of toxic emissions. Margolick and Russell (2001) and Reinhardt (2000) report that corporate managers cited employee retention and recruitment as reasons for taking voluntary action.

Voluntary corporate-wide emissions targets for GHGs have become particularly popular. For example, Hoffman (2005) finds that as many as 60 US corporations have adopted corporate GHG emissions reduction targets and that some of these companies have participated in one of several partnership programmes run by NGOs (see Box 13.9). Under many of these programmes, companies develop a corporate GHG inventory and adopt an emission target. These targets take different forms, including absolute targets and intensity targets based on emissions or energy use per unit of production or sales (Margolick and Russell, 2001; King *et al*., 2004). Corporate targets have also been implemented with internal trading systems, such as those operated by British Petroleum (Margolick and Russell, 2001; Akhurst *et al*., 2003) and Petroleos Mexicana (PEMEX) (Bygrave, 2004).

Levy and Newell (2005) describe how the business sector, sometimes in partnership with NGOs, has initiated environmental certification or standardization regimes to fulfill a quasi-governmental role or to augment the role of governments. One of the most widely-used examples of this type of standard setting is the Greenhouse Gas Protocol, an initiative organized by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI) to develop an internationally accepted accounting and reporting standard for GHGs (WRI/WBCSD, 2004). The WRI/WBCSD reporting standard has been used by corporations, NGOs and government voluntary programmes. The International Standards Organization (ISO), based on the WRI/WBCSD, has adopted standards for the reporting of GHGs at the company and project level.[51]

Other standardization or certification efforts have been formed to support markets for project-based mechanisms or emissions trading. For example, the International Financial Reporting Interpretations Committee (IFRIC), which is the interpretive arm of the International Accounting Standards Board (IASB), has issued guidelines on financial accounting for emission allowances.[52] The International Emissions Trading

51 The relevant ISO standards are ISO 14064 Part 1. This may be found at: http://www.iso.org/iso/en/CatalogueDetailPage.CatalogueDetail?CSNUMBER=38381&scopelist=PROGRAMME

52 See http://www.iasb.org/news/index.asp?showPageContent=no&xml=10_262_25_02122004_31122009.htm

Box 13.9 Examples of private partnerships and programmes

Business Leader Initiative on Climate Change (BLICC): Under this initiative, five European companies monitor and report their GHG emissions and set a reduction target. See http://www.respecteurope.com/rt2/BLICC/

Carbon Disclosure Project: Under this project, 940 companies report their GHG emissions. The project is supported by institutional investors controlling about 25% of the global stock markets. See http://www.cdproject.net

Carbon Trust: The Carbon Trust is a not-for-profit company set up by the UK government to reduce carbon emissions. The Trust provides technical assistance, investment funds and other services to companies on emission reduction strategies and for the development of new technologies. See http://www.thecarbontrust.co.uk/default.ct

Cement Sustainability Initiative: Ten companies have developed 'The Cement Sustainability Initiative' for 2002–2007 under the umbrella of the World Business Council for Sustainable Development. This initiative out-lines individual or joint actions to set emissions targets and monitor and report emissions.

Chicago Climate Exchange: The Chicago Climate Exchange is a GHG emission reduction and trading pilot programme for emission sources and offset projects in the USA, Canada and Mexico. It is a self-regulatory, rules-based exchange designed and governed by the members who have made a voluntary commitment to reduce their GHG emissions by 4% below the average of their 1998–2001 baseline by 2006. See http://www.chicagoclimatex.com

Offset Programmes: Braun and Stute (2004) identified 35 organizations that offer services to offset the emissions of companies, communities and private individuals. These organizations first calculate the emissions of their participants and then undertake emission reduction or carbon sequestration projects or acquire and retire emission reduction units or emission allowances.

Pew Center on Climate Change Business Environmental Leadership Council: Under this initiative, 41 companies establish emissions reduction objectives, invest in new, more efficient products, practices, and technologies and support actions to achieve cost-effective emissions reductions. See: http://www.pewclimate.org/companies_leading_the_way_belc/

Top ten consumer information system: This NGO-sponsored programme provides consumers with information on the most efficient consumer products and services available in local markets. The service is available in ten EU countries, with plans to expand to China and Latin America. See http://www.topten.info

WWF Climate Savers: The NGO World Wide Fund of Nature (WWF) has build partnerships with individual leading corporations that pledge to reduce their global warming emissions worldwide by 7% below 1990 levels by the year 2010. Six companies have entered this programme. See http://www.panda.org/about_wwf/what_we_do/climate_change/our_solutions/business_industry/climate_savers/ index.cfm

Association, together with the World Bank Carbon Finance Group/Prototype Carbon Fund have developed a validation and verification manual to be used by stakeholders involved in developing, financing, validating and verifying CDM and JI projects.

13.4.3 Litigation related to climate change

The authors of many technical articles point out that litigation is likely to be used increasingly as countries and citizens become dissatisfied with the pace of international and national decision-making on climate change (Penalver, 1998; Marburg, 2001; Weisslitz, 2002; Allen, 2003; Grossman, 2003; Verheyen, 2003; Gillespie, 2004; Thackeray, 2004; Dlugolecki, 2005; Hancock, 2005; Jacobs, 2005; Lipanovich, 2005; Mank, 2005). These authors argue that the possible causes of action in litigation include (1) customary law principle of state responsibility, (2) nuisance and the no-harm principle, (3) violation of international agreements including the WTO and the United National Convention on the Law of the Sea (UNCLOS) and the violation of human rights and (4) the abdication of authority by states to legislate on environmental issues based on the existing environmental legislation in the country concerned. However, they also emphasize that although there are often strong legal grounds for taking action, there may also be reasons for a strong defence.

Gillespie (2004) argues that if the international process is arguably not taking place in good faith, there is sound reason for requesting the International Court of Justice for an Advisory Opinion in this area, especially when the significant (potential) harm faced by small island states are taken into account. Jacobs (2005) and Verheyen (2003) analysed the potential case for a small island state actually suing the USA before the International

Court of Justice. Burns (2004) and Doelle (2004) point out that non-ratification of the Kyoto Protocol could imply illegal subsidies to national industries under the WTO and pollution of the seas under UNCLOS. Hancock (2005) sees the potential for liability suits increasing and advises companies to disclose their emissions to the Securities and Exchange Commission as a step to limit liability. Issues of causality are being dealt with in the literature (Allen, 2003) and through precedent (Lipanovich, 2005).

There are currently a number of court cases in Kyoto Party countries, both developed (Germany) and developing (Nigeria), and non-Parties (Australia and the USA). For example, in Germany, NGOs have sued the export credit support agencies for not disclosing information on the GHG emissions of the projects they support in developing countries. (See www.climatelaw.org/media/german.suit). A similar case was filed in the US District Court for the Northern District of California, on August 26, 2002 by Friends of the Earth, Greenpeace and the city of Boulder, Colorado, which have sued the Export-Import Bank and the Overseas Private Investment Corporation under the National Environmental Policy Act, alleging that these two US government agencies had provided 32 billion US$ for supporting the finance and insurance of oil fields, pipelines and coal-fired plants in developing countries over the previous 10 years without assessing the impacts on the environment including global warming. A Federal Judge in California has ruled in favour of the plaintiffs.[53]

In a case filed in Argentina, the plaintiffs allege a violation of Article 6 of the Climate Convention. In Nigeria, NGOs have sued the major oil companies and the state for continuing gas flaring, an industrial process which contributes about 70 million tonnes of CO_2 annually to global GHG emissions (Climate Justice Programme, 2005) and which is viewed as a violation of the Convention and the human rights of the local people.[54] In Australia, NGOs have filed a suit against a minister for permitting a mine expansion project without examining the GHG emissions. See www.austlii.edu.au/au/cases/vic/VCAT/2004/2029.html.

There are two law cases in the USA where a coalition of states[55] and environmental NGOs argue that the US EPA has the authority to regulate CO_2 and other GHGs as air pollutants under the Clean Air Act.[56] In addition, eight US States, New York City and two land conservation trusts initiated a lawsuit in July 2004 against the five US power companies with the largest CO_2 emissions, on the grounds that these companies contribute to a public nuisance (global warming). That case, though dismissed by the trial court, is on appeal.[57] Non-government organizations in Australia have also given notice to the major GHG emitters in the USA about their obligations under national and international law to reduce their emissions (http://www.cana.net.au/documents/legal/aus_fin_rev.doc). In July 2005, a wildlife organization sued the Australian Government for failing to protect the Great Barrier Reef (http://www.climatelaw.org/media/Australia.emissions.suit). A court case was filed in December 2005 by the Inuit people before the Inter-American Commission of Human Rights against the US government for human rights violations of the Inuit people's way of life.[58] There have also been cases that have challenged the allocation of emission allowances. With the entry into force of the EU Emissions Trading Directive,[59] there has been some litigation in Germany that has challenged the manner in which the German Government has interpreted and transposed the directive into its National Allocation Plan in 2004[60]. The courts have thus far decided that the Emission Allocation Law is in conformity with German law and with European rules on property rights.[61]

While many of the these legal cases have not yet led to interim judgments in favour of the plaintiff, they do reveal there is a decided interest in pursuing the legal route as the means to pushing for action on climate change. These cases are based on a number of different legal grounds for doing so, but it may take some years before courts decide which, if any, of these grounds are valid.

13.4.4 Interactions between private, local and non-governmental initiatives and national/international efforts

The preceding sections have touched on a number of the interactions that take place between private, sub-national and non-governmental initiatives and national and international climate change efforts. As discussed, some of these efforts have been designed, at least in part, to influence the development of

53 Order Denying Defendants' Motion for Summary Judgment, in the case of Friends of the earth, Greenpeace, Inc. and City of Boulder Colorado versus Peter Watson (Overseas Private Investment Corporation) and Phillip Lerrill (Export-Import Bank of the United States), No. C 02-4106 JSW.

54 Suit No. FHC/CS/B/126/2005; filed in the Federal High Court of Nigeria, in the Benin Judicial Division, Holden at Benin City.

55 California, Connecticut, Illinois, Maine, Massachusetts, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont and Washington together with New York City, Baltimore, and Washington, DC.

56 Massachusetts vs. Environmental Protection Agency, 415 F.3d 50 (D.C. Cir. 2005). A petition for Supreme Court review is pending. This case concerns motor vehicle emissions. Another case has been filed in the US Court of Appeals for the District of Columbia Circuit by a coalition of states and NGOs led by New York over an EPA decision not to regulate CO_2 from power plants.

57 Connecticut, *et al*. vs. American Electric Power Company Inc., *et al*.; 406 F.Supp.2d 265 (S.D.N.Y. 2005), appeal pending in the Court of Appeals for the Second Circuit.

58 Petition to the Inter-American Commission on Human Rights Seeking Relief From Violations Resulting From Global Warming Caused by Acts and Omissions of the United States, December 7, 2005.

59 Directive 2003/87/EC of the European Parliament and the Council of 13 October 2003 (OJ L 275, 25-10-2003), establishing a scheme for GHG allowance trading within the community and amending Council Directive 96/61/EC (OJ L257, 10-10-1996); available at < http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_275/l_27520031025en00320046.pdf>

60 Gesetz über den nationalen Zuteilungsplan für Treibhausgasemissionsberechtigungen in der Zuteilungsperiode 2005-2007 (Zuteilungsgesetz 2007 - ZuG2007), Bundesgesetzblatt Jahrgang 2004, Teil I, Nr. 45, 30. August 2004.

61 Beschluss vom 1.9.2004, NVwZ2004, S.1389 ff; Beschluss vom 18.10.2004, NVwZ2005, S.112 ff; BverwG, Urteil vom 309.6.2005, NVwZ2005, S. 1178ff.

national programmes or the international climate regime. Other programmes have been designed to fill roles in these regimes that may be appropriate for private or non-governmental entities. Finally, other legal or programmatic initiatives have been launched because of the perceived inadequacy of national or international efforts.

One of the most important drivers of these interactions is the development of a global GHG emission trading market. Many of the standardization and certification efforts described above have been designed to build institutions for the emerging GHG market which in turn may also facilitate interactions between sub-national initiatives and national or international climate regimes. For example, the eight north-eastern and mid-Atlantic states in the US Regional Greenhouse Gas Initiative (RGGI) cap and trade programme will allow the use of CDM credits and EU ETS allowances under certain circumstances (RGGI, 2005). Similarly, there has been an exploration of a possible linkage between the NSW Greenhouse Gas abatement scheme and the EU ETS and Kyoto mechanisms (Fowler, 2004; Betz and MacGill, 2005).

In addition to international carbon markets, there are other frameworks that facilitate interactions between private, sub-national, and non-governmental initiatives and national and international climate change efforts. For example, NGOs, private companies and governments have formed partnerships to help implement the World Summit on Sustainable Development (WSSD). These partnerships, known as 'type II agreements' are self-organized and are formed as voluntary cooperative initiatives and have the common goal of integrating the economic, social and environmental dimensions of sustainable development. To date, more than 300 partnerships are registered. A significant number of these partnerships are climate change-related (see http://www.un.org/esa/sustdev/partnerships/partnerships.htm).

13.5 Implications for global climate change policy

This chapter has provided information on the national and international policy options available to governments and the global community to address global climate change. We note that there are many tools available and that each has its own unique advantages and disadvantages. While further studies are likely to yield additional insights, particularly with respect to the implementation of policy choices, it is unlikely that the suite of policies available to governments will grow substantially in the future.

With this in mind, it is useful to consider several questions in the light of the following background information. Since the IPCC was formed nearly 20 years ago atmospheric GHG concentrations have gone up from 354 to 385 ppm (or approximately 25% of the total increase since the pre-industrial level of 270 ppm) as the emissions of GHG have risen (see http://cdiac.ornl.gov/ftp/trends/CO_2/maunaloa. CO_2). We have measurement data that indicates that the world is warming, and we can calculate, given the data on past and current emissions, that there is at the present time approximately 0.6 degrees of additional warming 'in the bank' (See IPCC, 2007a). Therefore:

- Why has the application of policies been so modest?
- Why is the global community not on a faster implementation track?
- Why have – at the very least – hedging strategies not emerged in many more countries?
- Is the scale of the problem too large for current institutions?
- Is there a lack of information on potential impacts or on low-cost options?
- Has policy-making been influenced by the special interests of a few?

Assuming that policies have been carefully designed, there appears to be no need to delay their implementation – indeed, there is an abundance of information in climate change literature that continues to suggest the non-climate benefits of many of these policies and the potential climate benefits of many non-climate policies. Moreover, as outlined in other chapters of this report, with a few exceptions, these policies would have only a very small impact on national economic growth – albeit the impact would be large in absolute terms.

One answer to these questions may lie in the complex nature of the policy-making processes – both for climate change policy and, even more importantly, in other areas at the national and sub-national level. For example, some of the most significant emissions reductions in both developed and developing countries have occurred at this intersection of policies (e.g. the switch to gas in the UK, the Chinese energy efficiency programmes for energy security, the Brazilian development of a bio-fuel-driven transport fleet, or the trend in the 1970s and 1980s toward nuclear power). Conversely, some of the most significant increases in emissions have been the result of non-climate policy priorities which have overwhelmed climate mitigation efforts (e.g. decisions in Canada to exploit the tar sands reserves, those in Brazil to clear forests for agriculture and those in the USA to promote coal-powered electricity generation to enhance energy security). Assessing how these mega-decisions are made and how they can be linked with climate change policies is the topic of chapter 12 and may be crucial to the future.

A second answer may be linked to the over-riding drive by all governments (reflecting both corporate and individual desires) for cheap and secure energy and for economic growth, to the competitive nature of the global economy and to the perception that any step, however modest, will disadvantage some special interest. Finding a way to mitigate the impacts on the losers – as well as create new winners – may be a key to accelerating the pace of policy implementation. Most importantly perhaps,

finding ways to eliminate the climate of 'fear' that prevents actions (or more aggressive actions) and to promote a climate of 'opportunity' may be crucial to moving beyond modest steps. As outlined in other chapters of this report, the impact of mitigation efforts on national economic growth is relatively small, although the economic impacts differ among countries and may be larger than the impacts of other environmental problems. Mitigation is also more complicated as it involves more political actors and greater levels of cooperation and/or coordination. In this respect, better estimates of the risks, costs and benefits of climate policies in terms of market and non-market terms as well as ethical terms may enable governments to make informed decisions.

From the literature reviewed in this chapter, it is clear that governments, companies and civil society have been actively grappling with these questions. The very diversity of the policy mix, the activism of NGOs and the wealth of modelling, research and analysis (even if, to date, these have yielded only modest changes in emissions) collectively provide a framework for taking additional steps.

New research might provide further insight into why some policies have succeeded – and why others have not. In particular, additional work is needed to bolster the currently sparse body of research addressing the concerns of developing countries. Understanding how to accelerate policy adoption may be the most important research topic for the immediate future. As this chapter and others have noted, technology and policy tools do exist for taking that significant first step in addressing climate change. Potential future agreements can take advantage of this learning to encourage economically prudent and politically feasible actions.

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Summary for Policymakers

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Introduction

The Working Group I contribution to the IPCC Fourth Assessment Report describes progress in understanding of the human and natural drivers of climate change,[1] observed climate change, climate processes and attribution, and estimates of projected future climate change. It builds upon past IPCC assessments and incorporates new findings from the past six years of research. Scientific progress since the Third Assessment Report (TAR) is based upon large amounts of new and more comprehensive data, more sophisticated analyses of data, improvements in understanding of processes and their simulation in models and more extensive exploration of uncertainty ranges.

The basis for substantive paragraphs in this Summary for Policymakers can be found in the chapter sections specified in curly brackets.

Human and Natural Drivers of Climate Change

Changes in the atmospheric abundance of greenhouse gases and aerosols, in solar radiation and in land surface properties alter the energy balance of the climate system. These changes are expressed in terms of radiative forcing,[2] which is used to compare how a range of human and natural factors drive warming or cooling influences on global climate. Since the TAR, new observations and related modelling of greenhouse gases, solar activity, land surface properties and some aspects of aerosols have led to improvements in the quantitative estimates of radiative forcing.

Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years (see Figure SPM.1). The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land use change, while those of methane and nitrous oxide are primarily due to agriculture. {2.3, 6.4, 7.3}

- Carbon dioxide is the most important anthropogenic greenhouse gas (see Figure SPM.2). The global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 ppm to 379 ppm[3] in 2005. The atmospheric concentration of carbon dioxide in 2005 exceeds by far the natural range over the last 650,000 years (180 to 300 ppm) as determined from ice cores. The annual carbon dioxide concentration growth rate was larger during the last 10 years (1995–2005 average: 1.9 ppm per year), than it has been since the beginning of continuous direct atmospheric measurements (1960–2005 average: 1.4 ppm per year) although there is year-to-year variability in growth rates. {2.3, 7.3}

- The primary source of the increased atmospheric concentration of carbon dioxide since the pre-industrial period results from fossil fuel use, with land-use change providing another significant but smaller contribution. Annual fossil carbon dioxide emissions[4] increased from an average of 6.4 [6.0 to 6.8][5] GtC (23.5 [22.0 to 25.0] $GtCO_2$) per year in the 1990s to 7.2 [6.9 to 7.5] GtC (26.4 [25.3 to 27.5] $GtCO_2$) per year in 2000–2005 (2004 and 2005 data are interim estimates). Carbon dioxide emissions associated with land-use change

[1] *Climate change* in IPCC usage refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the United Nations Framework Convention on Climate Change, where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.

[2] *Radiative forcing* is a measure of the influence that a factor has in altering the balance of incoming and outgoing energy in the Earth-atmosphere system and is an index of the importance of the factor as a potential climate change mechanism. Positive forcing tends to warm the surface while negative forcing tends to cool it. In this report, radiative forcing values are for 2005 relative to pre-industrial conditions defined at 1750 and are expressed in watts per square metre ($W\ m^{-2}$). See Glossary and Section 2.2 for further details.

[3] ppm (parts per million) or ppb (parts per billion, 1 billion = 1,000 million) is the ratio of the number of greenhouse gas molecules to the total number of molecules of dry air. For example, 300 ppm means 300 molecules of a greenhouse gas per million molecules of dry air.

[4] Fossil carbon dioxide emissions include those from the production, distribution and consumption of fossil fuels and as a by-product from cement production. An emission of 1 GtC corresponds to 3.67 $GtCO_2$.

[5] In general, uncertainty ranges for results given in this Summary for Policymakers are 90% uncertainty intervals unless stated otherwise, that is, there is an estimated 5% likelihood that the value could be above the range given in square brackets and 5% likelihood that the value could be below that range. Best estimates are given where available. Assessed uncertainty intervals are not always symmetric about the corresponding best estimate. Note that a number of uncertainty ranges in the Working Group I TAR corresponded to 2 standard deviations (95%), often using expert judgement.

Changes in Greenhouse Gases from Ice Core and Modern Data

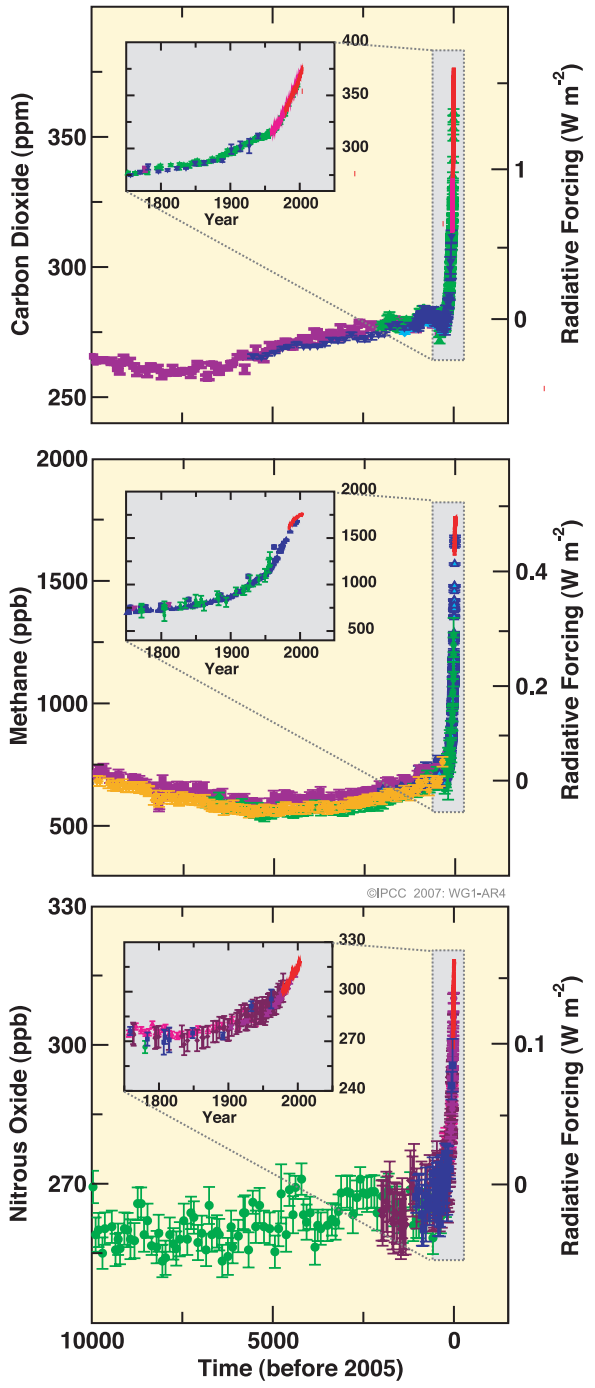


Figure SPM.1. *Atmospheric concentrations of carbon dioxide, methane and nitrous oxide over the last 10,000 years (large panels) and since 1750 (inset panels). Measurements are shown from ice cores (symbols with different colours for different studies) and atmospheric samples (red lines). The corresponding radiative forcings are shown on the right hand axes of the large panels. {Figure 6.4}*

are estimated to be 1.6 [0.5 to 2.7] GtC (5.9 [1.8 to 9.9] $GtCO_2$) per year over the 1990s, although these estimates have a large uncertainty. {7.3}

- The global atmospheric concentration of methane has increased from a pre-industrial value of about 715 ppb to 1732 ppb in the early 1990s, and was 1774 ppb in 2005. The atmospheric concentration of methane in 2005 exceeds by far the natural range of the last 650,000 years (320 to 790 ppb) as determined from ice cores. Growth rates have declined since the early 1990s, consistent with total emissions (sum of anthropogenic and natural sources) being nearly constant during this period. It is *very likely*[6] that the observed increase in methane concentration is due to anthropogenic activities, predominantly agriculture and fossil fuel use, but relative contributions from different source types are not well determined. {2.3, 7.4}

- The global atmospheric nitrous oxide concentration increased from a pre-industrial value of about 270 ppb to 319 ppb in 2005. The growth rate has been approximately constant since 1980. More than a third of all nitrous oxide emissions are anthropogenic and are primarily due to agriculture. {2.3, 7.4}

The understanding of anthropogenic warming and cooling influences on climate has improved since the TAR, leading to *very high confidence*[7] that the global average net effect of human activities since 1750 has been one of warming, with a radiative forcing of +1.6 [+0.6 to +2.4] W m^{-2} (see Figure SPM.2). {2.3., 6.5, 2.9}

- The combined radiative forcing due to increases in carbon dioxide, methane, and nitrous oxide is +2.30 [+2.07 to +2.53] W m^{-2}, and its rate of increase during the industrial era is *very likely* to have been unprecedented in more than 10,000 years (see Figures

[6] In this Summary for Policymakers, the following terms have been used to indicate the assessed likelihood, using expert judgement, of an outcome or a result: *Virtually certain* > 99% probability of occurrence, *Extremely likely* > 95%, *Very likely* > 90%, *Likely* > 66%, *More likely than not* > 50%, *Unlikely* < 33%, *Very unlikely* < 10%, *Extremely unlikely* < 5% (see Box TS.1 for more details).

[7] In this Summary for Policymakers the following levels of confidence have been used to express expert judgements on the correctness of the underlying science: *very high confidence* represents at least a 9 out of 10 chance of being correct; *high confidence* represents about an 8 out of 10 chance of being correct (see Box TS.1)

SPM.1 and SPM.2). The carbon dioxide radiative forcing increased by 20% from 1995 to 2005, the largest change for any decade in at least the last 200 years. {2.3, 6.4}

- Anthropogenic contributions to aerosols (primarily sulphate, organic carbon, black carbon, nitrate and dust) together produce a cooling effect, with a total direct radiative forcing of –0.5 [–0.9 to –0.1] W m^{-2} and an indirect cloud albedo forcing of –0.7 [–1.8 to –0.3] W m^{-2}. These forcings are now better understood than at the time of the TAR due to improved *in situ*, satellite and ground-based measurements and more comprehensive modelling, but remain the dominant uncertainty in radiative forcing. Aerosols also influence cloud lifetime and precipitation. {2.4, 2.9, 7.5}

- Significant anthropogenic contributions to radiative forcing come from several other sources. Tropospheric ozone changes due to emissions of ozone-forming chemicals (nitrogen oxides, carbon monoxide, and hydrocarbons) contribute +0.35 [+0.25 to +0.65] W m^{-2}. The direct radiative forcing due to changes in halocarbons[8] is +0.34 [+0.31 to +0.37] W m^{-2}. Changes in surface albedo, due to land cover changes and deposition of black carbon aerosols on snow, exert

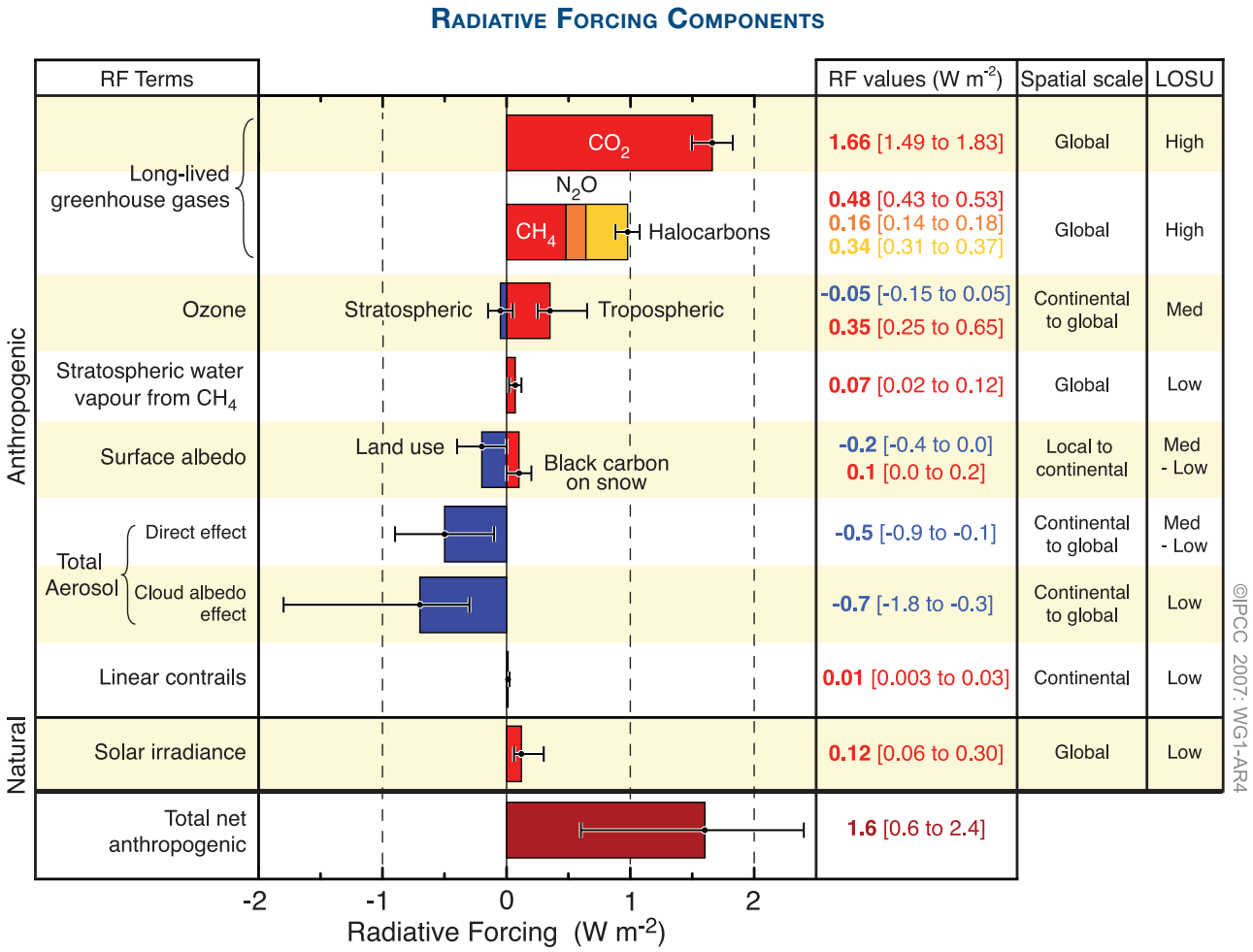


Figure SPM.2. *Global average radiative forcing (RF) estimates and ranges in 2005 for anthropogenic carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and other important agents and mechanisms, together with the typical geographical extent (spatial scale) of the forcing and the assessed level of scientific understanding (LOSU). The net anthropogenic radiative forcing and its range are also shown. These require summing asymmetric uncertainty estimates from the component terms, and cannot be obtained by simple addition. Additional forcing factors not included here are considered to have a very low LOSU. Volcanic aerosols contribute an additional natural forcing but are not included in this figure due to their episodic nature. The range for linear contrails does not include other possible effects of aviation on cloudiness. {2.9, Figure 2.20}*

[8] Halocarbon radiative forcing has been recently assessed in detail in *IPCC's Special Report on Safeguarding the Ozone Layer and the Global Climate System* (2005).

respective forcings of –0.2 [–0.4 to 0.0] and +0.1 [0.0 to +0.2] W m^{-2}. Additional terms smaller than ±0.1 W m^{-2} are shown in Figure SPM.2. {2.3, 2.5, 7.2}

- Changes in solar irradiance since 1750 are estimated to cause a radiative forcing of +0.12 [+0.06 to +0.30] W m^{-2}, which is less than half the estimate given in the TAR. {2.7}

Direct Observations of Recent Climate Change

Since the TAR, progress in understanding how climate is changing in space and in time has been gained through improvements and extensions of numerous datasets and data analyses, broader geographical coverage, better understanding of uncertainties, and a wider variety of measurements. Increasingly comprehensive observations are available for glaciers and snow cover since the 1960s, and for sea level and ice sheets since about the past decade. However, data coverage remains limited in some regions.

Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level (see Figure SPM.3). {3.2, 4.2, 5.5}

- Eleven of the last twelve years (1995–2006) rank among the 12 warmest years in the instrumental record of global surface temperature[9] (since 1850). The updated 100-year linear trend (1906 to 2005) of 0.74°C [0.56°C to 0.92°C] is therefore larger than the corresponding trend for 1901 to 2000 given in the TAR of 0.6°C [0.4°C to 0.8°C]. The linear warming trend over the last 50 years (0.13°C [0.10°C to 0.16°C] per decade) is nearly twice that for the last 100 years. The total temperature increase from 1850–1899 to 2001–2005 is 0.76°C [0.57°C to 0.95°C]. Urban heat island effects are real but local, and have a negligible influence (less than 0.006°C per decade over land and zero over the oceans) on these values. {3.2}

- New analyses of balloon-borne and satellite measurements of lower- and mid-tropospheric temperature show warming rates that are similar to those of the surface temperature record and are consistent within their respective uncertainties, largely reconciling a discrepancy noted in the TAR. {3.2, 3.4}

- The average atmospheric water vapour content has increased since at least the 1980s over land and ocean as well as in the upper troposphere. The increase is broadly consistent with the extra water vapour that warmer air can hold. {3.4}

- Observations since 1961 show that the average temperature of the global ocean has increased to depths of at least 3000 m and that the ocean has been absorbing more than 80% of the heat added to the climate system. Such warming causes seawater to expand, contributing to sea level rise (see Table SPM.1). {5.2, 5.5}

- Mountain glaciers and snow cover have declined on average in both hemispheres. Widespread decreases in glaciers and ice caps have contributed to sea level rise (ice caps do not include contributions from the Greenland and Antarctic Ice Sheets). (See Table SPM.1.) {4.6, 4.7, 4.8, 5.5}

- New data since the TAR now show that losses from the ice sheets of Greenland and Antarctica have *very likely* contributed to sea level rise over 1993 to 2003 (see Table SPM.1). Flow speed has increased for some Greenland and Antarctic outlet glaciers, which drain ice from the interior of the ice sheets. The corresponding increased ice sheet mass loss has often followed thinning, reduction or loss of ice shelves or loss of floating glacier tongues. Such dynamical ice loss is sufficient to explain most of the Antarctic net mass loss and approximately half of the Greenland net mass loss. The remainder of the ice loss from Greenland has occurred because losses due to melting have exceeded accumulation due to snowfall. {4.6, 4.8, 5.5}

- Global average sea level rose at an average rate of 1.8 [1.3 to 2.3] mm per year over 1961 to 2003. The rate was faster over 1993 to 2003: about 3.1 [2.4 to 3.8] mm per year. Whether the faster rate for 1993 to 2003 reflects decadal variability or an increase in the longer-term trend is unclear. There is *high confidence* that

[9] The average of near-surface air temperature over land and sea surface temperature.

Changes in Temperature, Sea Level and Northern Hemisphere Snow Cover

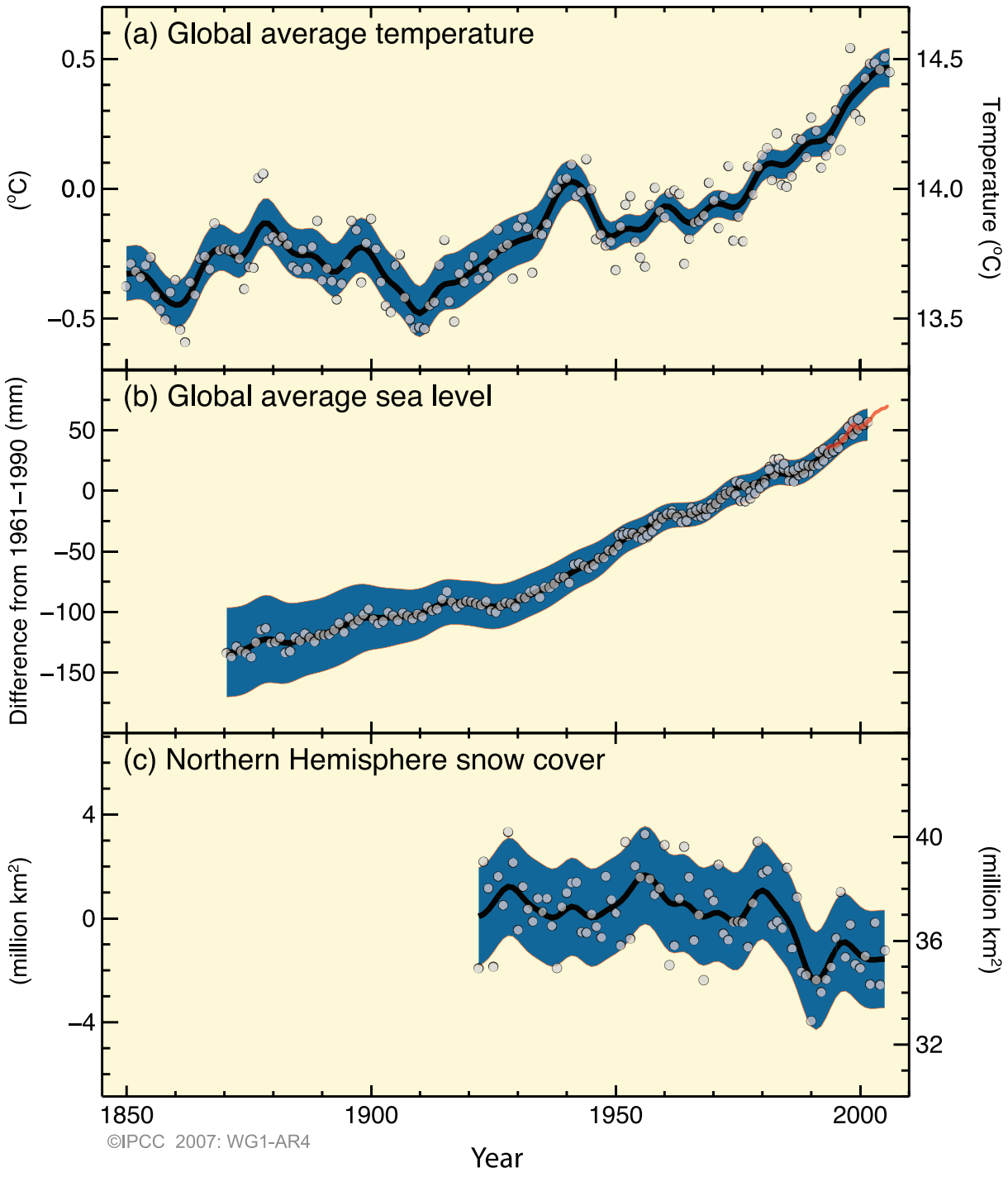


Figure SPM.3. *Observed changes in (a) global average surface temperature, (b) global average sea level from tide gauge (blue) and satellite (red) data and (c) Northern Hemisphere snow cover for March-April. All changes are relative to corresponding averages for the period 1961–1990. Smoothed curves represent decadal average values while circles show yearly values. The shaded areas are the uncertainty intervals estimated from a comprehensive analysis of known uncertainties (a and b) and from the time series (c). {FAQ 3.1, Figure 1, Figure 4.2, Figure 5.13}*

the rate of observed sea level rise increased from the 19th to the 20th century. The total 20th-century rise is estimated to be 0.17 [0.12 to 0.22] m. {5.5}

- For 1993 to 2003, the sum of the climate contributions is consistent within uncertainties with the total sea level rise that is directly observed (see Table SPM.1). These estimates are based on improved satellite and *in situ* data now available. For the period 1961 to 2003, the sum of climate contributions is estimated to be smaller than the observed sea level rise. The TAR reported a similar discrepancy for 1910 to 1990. {5.5}

At continental, regional and ocean basin scales, numerous long-term changes in climate have been observed. These include changes in arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones.[10] {3.2, 3.3, 3.4, 3.5, 3.6, 5.2}

- Average arctic temperatures increased at almost twice the global average rate in the past 100 years. Arctic temperatures have high decadal variability, and a warm period was also observed from 1925 to 1945. {3.2}

- Satellite data since 1978 show that annual average arctic sea ice extent has shrunk by 2.7 [2.1 to 3.3]% per decade, with larger decreases in summer of 7.4 [5.0 to 9.8]% per decade. These values are consistent with those reported in the TAR. {4.4}

- Temperatures at the top of the permafrost layer have generally increased since the 1980s in the Arctic (by up to 3°C). The maximum area covered by seasonally frozen ground has decreased by about 7% in the Northern Hemisphere since 1900, with a decrease in spring of up to 15%. {4.7}

- Long-term trends from 1900 to 2005 have been observed in precipitation amount over many large regions.[11] Significantly increased precipitation has been observed in eastern parts of North and South America, northern Europe and northern and central Asia. Drying has been observed in the Sahel, the Mediterranean, southern Africa and parts of southern Asia. Precipitation is highly variable spatially and temporally, and data are limited in some regions. Long-term trends have not been observed for the other large regions assessed.[11] {3.3, 3.9}

- Changes in precipitation and evaporation over the oceans are suggested by freshening of mid- and high-latitude waters together with increased salinity in low-latitude waters. {5.2}

Table SPM.1. *Observed rate of sea level rise and estimated contributions from different sources. {5.5, Table 5.3}*

Source of sea level rise	Rate of sea level rise (mm per year) 1961–2003	1993–2003
Thermal expansion	0.42 ± 0.12	1.6 ± 0.5
Glaciers and ice caps	0.50 ± 0.18	0.77 ± 0.22
Greenland Ice Sheet	0.05 ± 0.12	0.21 ± 0.07
Antarctic Ice Sheet	0.14 ± 0.41	0.21 ± 0.35
Sum of individual climate contributions to sea level rise	1.1 ± 0.5	2.8 ± 0.7
Observed total sea level rise	1.8 ± 0.5[a]	3.1 ± 0.7[a]
Difference (Observed minus sum of estimated climate contributions)	0.7 ± 0.7	0.3 ± 1.0

Table note:
[a] Data prior to 1993 are from tide gauges and after 1993 are from satellite altimetry.

[10] Tropical cyclones include hurricanes and typhoons.

[11] The assessed regions are those considered in the regional projections chapter of the TAR and in Chapter 11 of this report.

- Mid-latitude westerly winds have strengthened in both hemispheres since the 1960s. {3.5}

- More intense and longer droughts have been observed over wider areas since the 1970s, particularly in the tropics and subtropics. Increased drying linked with higher temperatures and decreased precipitation has contributed to changes in drought. Changes in sea surface temperatures, wind patterns and decreased snowpack and snow cover have also been linked to droughts. {3.3}

- The frequency of heavy precipitation events has increased over most land areas, consistent with warming and observed increases of atmospheric water vapour. {3.8, 3.9}

- Widespread changes in extreme temperatures have been observed over the last 50 years. Cold days, cold nights and frost have become less frequent, while hot days, hot nights and heat waves have become more frequent (see Table SPM.2). {3.8}

Table SPM.2. *Recent trends, assessment of human influence on the trend and projections for extreme weather events for which there is an observed late-20th century trend. {Tables 3.7, 3.8, 9.4; Sections 3.8, 5.5, 9.7, 11.2–11.9}*

Phenomenon[a] and direction of trend	Likelihood that trend occurred in late 20th century (typically post 1960)	Likelihood of a human contribution to observed trend[b]	Likelihood of future trends based on projections for 21st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	*Very likely*[c]	*Likely*[d]	*Virtually certain*[d]
Warmer and more frequent hot days and nights over most land areas	*Very likely*[e]	*Likely (nights)*[d]	*Virtually certain*[d]
Warm spells/heat waves. Frequency increases over most land areas	*Likely*	*More likely than not*[f]	*Very likely*
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	*Likely*	*More likely than not*[f]	*Very likely*
Area affected by droughts increases	*Likely* in many regions since 1970s	*More likely than not*	*Likely*
Intense tropical cyclone activity increases	*Likely* in some regions since 1970	*More likely than not*[f]	*Likely*
Increased incidence of extreme high sea level (excludes tsunamis)[g]	*Likely*	*More likely than not*[f,h]	*Likely*[i]

Table notes:

[a] See Table 3.7 for further details regarding definitions.

[b] See Table TS.4, Box TS.5 and Table 9.4.

[c] Decreased frequency of cold days and nights (coldest 10%).

[d] Warming of the most extreme days and nights each year.

[e] Increased frequency of hot days and nights (hottest 10%).

[f] Magnitude of anthropogenic contributions not assessed. Attribution for these phenomena based on expert judgement rather than formal attribution studies.

[g] Extreme high sea level depends on average sea level and on regional weather systems. It is defined here as the highest 1% of hourly values of observed sea level at a station for a given reference period.

[h] Changes in observed extreme high sea level closely follow the changes in average sea level. {5.5} It is *very likely* that anthropogenic activity contributed to a rise in average sea level. {9.5}

[i] In all scenarios, the projected global average sea level at 2100 is higher than in the reference period. {10.6} The effect of changes in regional weather systems on sea level extremes has not been assessed.

- There is observational evidence for an increase in intense tropical cyclone activity in the North Atlantic since about 1970, correlated with increases of tropical sea surface temperatures. There are also suggestions of increased intense tropical cyclone activity in some other regions where concerns over data quality are greater. Multi-decadal variability and the quality of the tropical cyclone records prior to routine satellite observations in about 1970 complicate the detection of long-term trends in tropical cyclone activity. There is no clear trend in the annual numbers of tropical cyclones. {3.8}

Some aspects of climate have not been observed to change. {3.2, 3.8, 4.4, 5.3}

- A decrease in diurnal temperature range (DTR) was reported in the TAR, but the data available then extended only from 1950 to 1993. Updated observations reveal that DTR has not changed from 1979 to 2004 as both day- and night-time temperature have risen at about the same rate. The trends are highly variable from one region to another. {3.2}

- Antarctic sea ice extent continues to show interannual variability and localised changes but no statistically significant average trends, consistent with the lack of warming reflected in atmospheric temperatures averaged across the region. {3.2, 4.4}

- There is insufficient evidence to determine whether trends exist in the meridional overturning circulation (MOC) of the global ocean or in small-scale phenomena such as tornadoes, hail, lightning and dust-storms. {3.8, 5.3}

A Palaeoclimatic Perspective

Palaeoclimatic studies use changes in climatically sensitive indicators to infer past changes in global climate on time scales ranging from decades to millions of years. Such proxy data (e.g., tree ring width) may be influenced by both local temperature and other factors such as precipitation, and are often representative of particular seasons rather than full years. Studies since the TAR draw increased confidence from additional data showing coherent behaviour across multiple indicators in different parts of the world. However, uncertainties generally increase with time into the past due to increasingly limited spatial coverage.

Palaeoclimatic information supports the interpretation that the warmth of the last half century is unusual in at least the previous 1,300 years. The last time the polar regions were significantly warmer than present for an extended period (about 125,000 years ago), reductions in polar ice volume led to 4 to 6 m of sea level rise. {6.4, 6.6}

- Average Northern Hemisphere temperatures during the second half of the 20th century were *very likely* higher than during any other 50-year period in the last 500 years and *likely* the highest in at least the past 1,300 years. Some recent studies indicate greater variability in Northern Hemisphere temperatures than suggested in the TAR, particularly finding that cooler periods existed in the 12th to 14th, 17th and 19th centuries. Warmer periods prior to the 20th century are within the uncertainty range given in the TAR. {6.6}

- Global average sea level in the last interglacial period (about 125,000 years ago) was *likely* 4 to 6 m higher than during the 20th century, mainly due to the retreat of polar ice. Ice core data indicate that average polar temperatures at that time were 3°C to 5°C higher than present, because of differences in the Earth's orbit. The Greenland Ice Sheet and other arctic ice fields *likely* contributed no more than 4 m of the observed sea level rise. There may also have been a contribution from Antarctica. {6.4}

Understanding and Attributing Climate Change

This assessment considers longer and improved records, an expanded range of observations and improvements in the simulation of many aspects of climate and its variability based on studies since the TAR. It also considers the results of new attribution studies that have evaluated whether observed changes are quantitatively consistent with the expected response to external forcings and inconsistent with alternative physically plausible explanations.

Most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations.[12] This is an advance since the TAR's conclusion that "most of the observed warming over the last 50 years is *likely* to have been due to the increase in greenhouse gas concentrations". Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns (see Figure SPM.4 and Table SPM.2). {9.4, 9.5}

- It is *likely* that increases in greenhouse gas concentrations alone would have caused more warming than observed because volcanic and anthropogenic aerosols have offset some warming that would otherwise have taken place. {2.9, 7.5, 9.4}

- The observed widespread warming of the atmosphere and ocean, together with ice mass loss, support the conclusion that it is *extremely unlikely* that global climate change of the past 50 years can be explained without external forcing, and *very likely* that it is not due to known natural causes alone. {4.8, 5.2, 9.4, 9.5, 9.7}

- Warming of the climate system has been detected in changes of surface and atmospheric temperatures in the upper several hundred metres of the ocean, and in contributions to sea level rise. Attribution studies have established anthropogenic contributions to all of these changes. The observed pattern of tropospheric warming and stratospheric cooling is *very likely* due to the combined influences of greenhouse gas increases and stratospheric ozone depletion. {3.2, 3.4, 9.4, 9.5}

- It is *likely* that there has been significant anthropogenic warming over the past 50 years averaged over each continent except Antarctica (see Figure SPM.4). The observed patterns of warming, including greater warming over land than over the ocean, and their changes over time, are only simulated by models that include anthropogenic forcing. The ability of coupled climate models to simulate the observed temperature evolution on each of six continents provides stronger evidence of human influence on climate than was available in the TAR. {3.2, 9.4}

- Difficulties remain in reliably simulating and attributing observed temperature changes at smaller scales. On these scales, natural climate variability is relatively larger, making it harder to distinguish changes expected due to external forcings. Uncertainties in local forcings and feedbacks also make it difficult to estimate the contribution of greenhouse gas increases to observed small-scale temperature changes. {8.3, 9.4}

- Anthropogenic forcing is *likely* to have contributed to changes in wind patterns,[13] affecting extra-tropical storm tracks and temperature patterns in both hemispheres. However, the observed changes in the Northern Hemisphere circulation are larger than simulated in response to 20th-century forcing change. {3.5, 3.6, 9.5, 10.3}

- Temperatures of the most extreme hot nights, cold nights and cold days are *likely* to have increased due to anthropogenic forcing. It is *more likely than not* that anthropogenic forcing has increased the risk of heat waves (see Table SPM.2). {9.4}

[12] Consideration of remaining uncertainty is based on current methodologies.

[13] In particular, the Southern and Northern Annular Modes and related changes in the North Atlantic Oscillation. {3.6, 9.5, Box TS.2}

Global and Continental Temperature Change

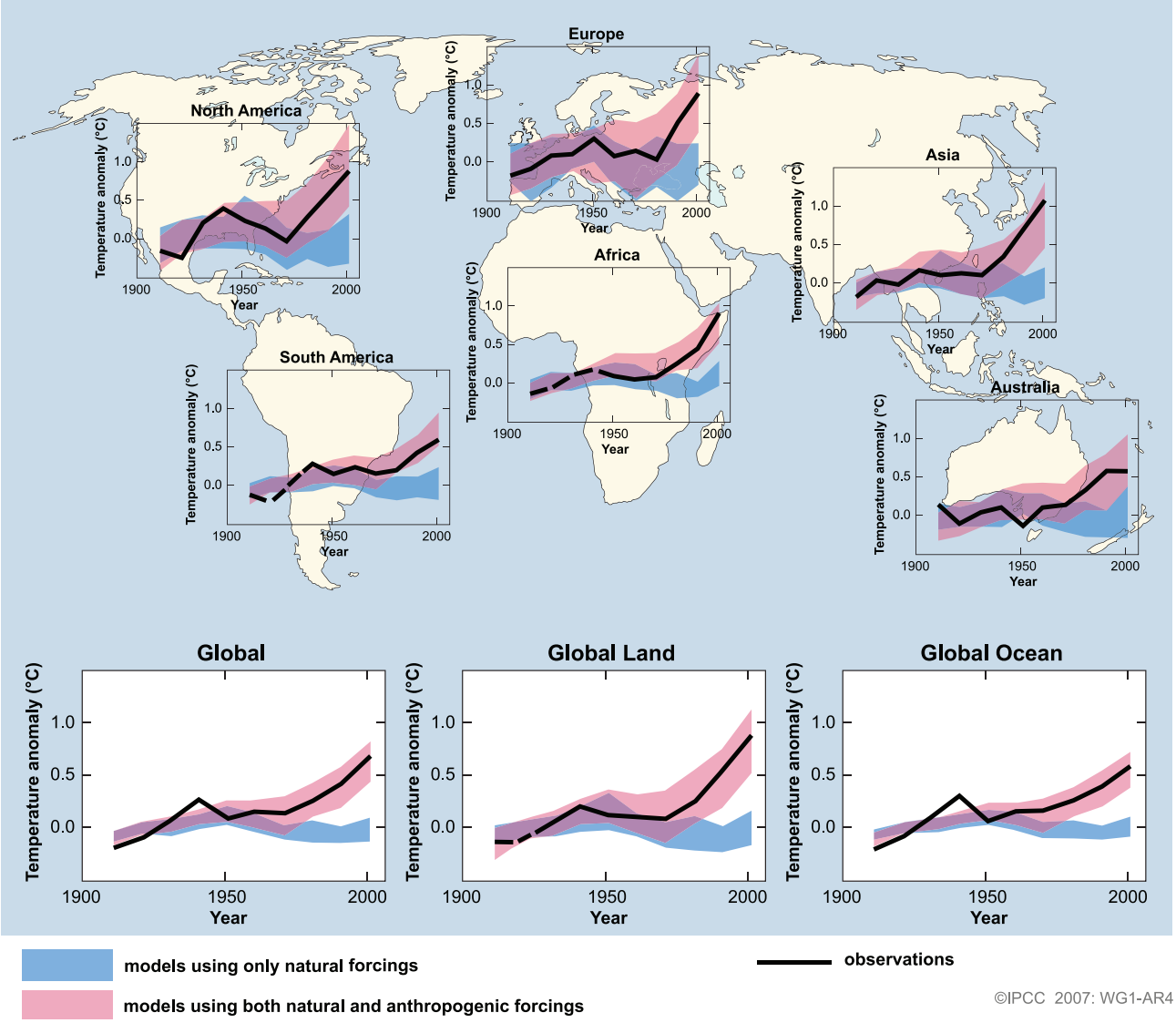


Figure SPM.4. *Comparison of observed continental- and global-scale changes in surface temperature with results simulated by climate models using natural and anthropogenic forcings. Decadal averages of observations are shown for the period 1906 to 2005 (black line) plotted against the centre of the decade and relative to the corresponding average for 1901–1950. Lines are dashed where spatial coverage is less than 50%. Blue shaded bands show the 5–95% range for 19 simulations from five climate models using only the natural forcings due to solar activity and volcanoes. Red shaded bands show the 5–95% range for 58 simulations from 14 climate models using both natural and anthropogenic forcings. {FAQ 9.2, Figure 1}*

Analysis of climate models together with constraints from observations enables an assessed *likely* range to be given for climate sensitivity for the first time and provides increased confidence in the understanding of the climate system response to radiative forcing. {6.6, 8.6, 9.6, Box 10.2}

- The equilibrium climate sensitivity is a measure of the climate system response to sustained radiative forcing. It is not a projection but is defined as the global average surface warming following a doubling of carbon dioxide concentrations. It is *likely* to be in the range 2°C to 4.5°C with a best estimate of about 3°C, and is *very unlikely* to be less than 1.5°C. Values substantially higher than 4.5°C cannot be excluded, but agreement of models with observations is not as good for those values. Water vapour changes represent the largest feedback affecting climate sensitivity and are now better understood than in the TAR. Cloud feedbacks remain the largest source of uncertainty. {8.6, 9.6, Box 10.2}

- It is *very unlikely* that climate changes of at least the seven centuries prior to 1950 were due to variability generated within the climate system alone. A significant fraction of the reconstructed Northern Hemisphere inter-decadal temperature variability over those centuries is *very likely* attributable to volcanic eruptions and changes in solar irradiance, and it is *likely* that anthropogenic forcing contributed to the early 20th-century warming evident in these records. {2.7, 2.8, 6.6, 9.3}

Projections of Future Changes in Climate

A major advance of this assessment of climate change projections compared with the TAR is the large number of simulations available from a broader range of models. Taken together with additional information from observations, these provide a quantitative basis for estimating likelihoods for many aspects of future climate change. Model simulations cover a range of possible futures including idealised emission or concentration assumptions. These include SRES[14] illustrative marker scenarios for the 2000 to 2100 period and model experiments with greenhouse gases and aerosol concentrations held constant after year 2000 or 2100.

For the next two decades, a warming of about 0.2°C per decade is projected for a range of SRES emission scenarios. Even if the concentrations of all greenhouse gases and aerosols had been kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected. {10.3, 10.7}

- Since IPCC's first report in 1990, assessed projections have suggested global average temperature increases between about 0.15°C and 0.3°C per decade for 1990 to 2005. This can now be compared with observed values of about 0.2°C per decade, strengthening confidence in near-term projections. {1.2, 3.2}

- Model experiments show that even if all radiative forcing agents were held constant at year 2000 levels, a further warming trend would occur in the next two decades at a rate of about 0.1°C per decade, due mainly to the slow response of the oceans. About twice as much warming (0.2°C per decade) would be expected if emissions are within the range of the SRES scenarios. Best-estimate projections from models indicate that decadal average warming over each inhabited continent by 2030 is insensitive to the choice among SRES scenarios and is *very likely* to be at least twice as large as the corresponding model-estimated natural variability during the 20th century. {9.4, 10.3, 10.5, 11.2–11.7, Figure TS-29}

[14] SRES refers to the *IPCC Special Report on Emission Scenarios* (2000). The SRES scenario families and illustrative cases, which did not include additional climate initiatives, are summarised in a box at the end of this Summary for Policymakers. Approximate carbon dioxide equivalent concentrations corresponding to the computed radiative forcing due to anthropogenic greenhouse gases and aerosols in 2100 (see p. 823 of the TAR) for the SRES B1, A1T, B2, A1B, A2 and A1FI illustrative marker scenarios are about 600, 700, 800, 850, 1250 and 1,550 ppm respectively. Scenarios B1, A1B and A2 have been the focus of model intercomparison studies and many of those results are assessed in this report.

Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would *very likely* be larger than those observed during the 20th century. {10.3}

- Advances in climate change modelling now enable best estimates and *likely* assessed uncertainty ranges to be given for projected warming for different emission scenarios. Results for different emission scenarios are provided explicitly in this report to avoid loss of this policy-relevant information. Projected global average surface warmings for the end of the 21st century (2090–2099) relative to 1980–1999 are shown in Table SPM.3. These illustrate the differences between lower and higher SRES emission scenarios, and the projected warming uncertainty associated with these scenarios. {10.5}

- Best estimates and *likely* ranges for global average surface air warming for six SRES emissions marker scenarios are given in this assessment and are shown in Table SPM.3. For example, the best estimate for the low scenario (B1) is 1.8°C (*likely* range is 1.1°C to 2.9°C), and the best estimate for the high scenario (A1FI) is 4.0°C (*likely* range is 2.4°C to 6.4°C). Although these projections are broadly consistent with the span quoted in the TAR (1.4°C to 5.8°C), they are not directly comparable (see Figure SPM.5). The Fourth Assessment Report is more advanced as it provides best estimates and an assessed likelihood range for each of the marker scenarios. The new assessment of the *likely* ranges now relies on a larger number of climate models of increasing complexity and realism, as well as new information regarding the nature of feedbacks from the carbon cycle and constraints on climate response from observations. {10.5}

- Warming tends to reduce land and ocean uptake of atmospheric carbon dioxide, increasing the fraction of anthropogenic emissions that remains in the atmosphere. For the A2 scenario, for example, the climate-carbon cycle feedback increases the corresponding global average warming at 2100 by more than 1°C. Assessed upper ranges for temperature projections are larger than in the TAR (see Table SPM.3) mainly because the broader range of models now available suggests stronger climate-carbon cycle feedbacks. {7.3, 10.5}

- Model-based projections of global average sea level rise at the end of the 21st century (2090–2099) are shown in Table SPM.3. For each scenario, the midpoint of the range in Table SPM.3 is within 10% of the

Table SPM.3. *Projected global average surface warming and sea level rise at the end of the 21st century. {10.5, 10.6, Table 10.7}*

	Temperature Change (°C at 2090-2099 relative to 1980-1999)[a]		Sea Level Rise (m at 2090-2099 relative to 1980-1999)
Case	Best estimate	*Likely* range	Model-based range excluding future rapid dynamical changes in ice flow
Constant Year 2000 concentrations[b]	0.6	0.3 – 0.9	NA
B1 scenario	1.8	1.1 – 2.9	0.18 – 0.38
A1T scenario	2.4	1.4 – 3.8	0.20 – 0.45
B2 scenario	2.4	1.4 – 3.8	0.20 – 0.43
A1B scenario	2.8	1.7 – 4.4	0.21 – 0.48
A2 scenario	3.4	2.0 – 5.4	0.23 – 0.51
A1FI scenario	4.0	2.4 – 6.4	0.26 – 0.59

Table notes:
[a] These estimates are assessed from a hierarchy of models that encompass a simple climate model, several Earth System Models of Intermediate Complexity and a large number of Atmosphere-Ocean General Circulation Models (AOGCMs).
[b] Year 2000 constant composition is derived from AOGCMs only.

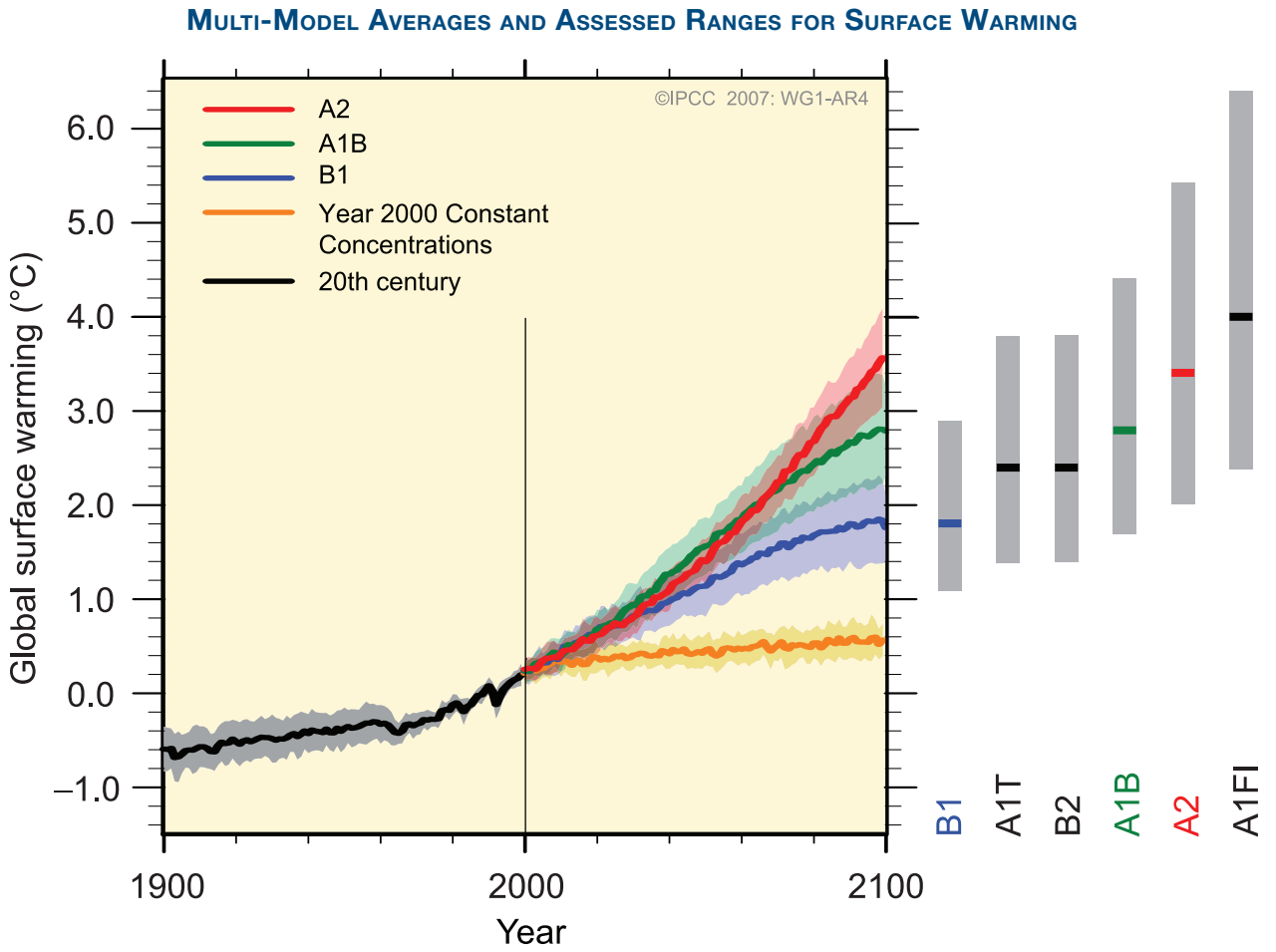


Figure SPM.5. *Solid lines are multi-model global averages of surface warming (relative to 1980–1999) for the scenarios A2, A1B and B1, shown as continuations of the 20th century simulations. Shading denotes the ±1 standard deviation range of individual model annual averages. The orange line is for the experiment where concentrations were held constant at year 2000 values. The grey bars at right indicate the best estimate (solid line within each bar) and the **likely** range assessed for the six SRES marker scenarios. The assessment of the best estimate and **likely** ranges in the grey bars includes the AOGCMs in the left part of the figure, as well as results from a hierarchy of independent models and observational constraints. {Figures 10.4 and 10.29}*

TAR model average for 2090–2099. The ranges are narrower than in the TAR mainly because of improved information about some uncertainties in the projected contributions.[15] {10.6}

- Models used to date do not include uncertainties in climate-carbon cycle feedback nor do they include the full effects of changes in ice sheet flow, because a basis in published literature is lacking. The projections include a contribution due to increased ice flow from Greenland and Antarctica at the rates observed for 1993 to 2003, but these flow rates could increase or decrease in the future. For example, if this contribution were to grow linearly with global average temperature change, the upper ranges of sea level rise for SRES scenarios shown in Table SPM.3 would increase by 0.1 to 0.2 m. Larger values cannot be excluded, but understanding of these effects is too limited to assess their likelihood or provide a best estimate or an upper bound for sea level rise. {10.6}

- Increasing atmospheric carbon dioxide concentrations lead to increasing acidification of the ocean. Projections based on SRES scenarios give reductions in average global surface ocean pH[16] of between 0.14 and 0.35 units over the 21st century, adding to the present decrease of 0.1 units since pre-industrial times. {5.4, Box 7.3, 10.4}

[15] TAR projections were made for 2100, whereas projections in this report are for 2090–2099. The TAR would have had similar ranges to those in Table SPM.3 if it had treated the uncertainties in the same way.

[16] Decreases in pH correspond to increases in acidity of a solution. See Glossary for further details.

There is now higher confidence in projected patterns of warming and other regional-scale features, including changes in wind patterns, precipitation and some aspects of extremes and of ice. {8.2, 8.3, 8.4, 8.5, 9.4, 9.5, 10.3, 11.1}

- Projected warming in the 21st century shows scenario-independent geographical patterns similar to those observed over the past several decades. Warming is expected to be greatest over land and at most high northern latitudes, and least over the Southern Ocean and parts of the North Atlantic Ocean (see Figure SPM.6). {10.3}

- Snow cover is projected to contract. Widespread increases in thaw depth are projected over most permafrost regions. {10.3, 10.6}

- Sea ice is projected to shrink in both the Arctic and Antarctic under all SRES scenarios. In some projections, arctic late-summer sea ice disappears almost entirely by the latter part of the 21st century. {10.3}

- It is *very likely* that hot extremes, heat waves and heavy precipitation events will continue to become more frequent. {10.3}

- Based on a range of models, it is *likely* that future tropical cyclones (typhoons and hurricanes) will become more intense, with larger peak wind speeds and more heavy precipitation associated with ongoing increases of tropical sea surface temperatures. There is less confidence in projections of a global decrease in numbers of tropical cyclones. The apparent increase in the proportion of very intense storms since 1970 in some regions is much larger than simulated by current models for that period. {9.5, 10.3, 3.8}

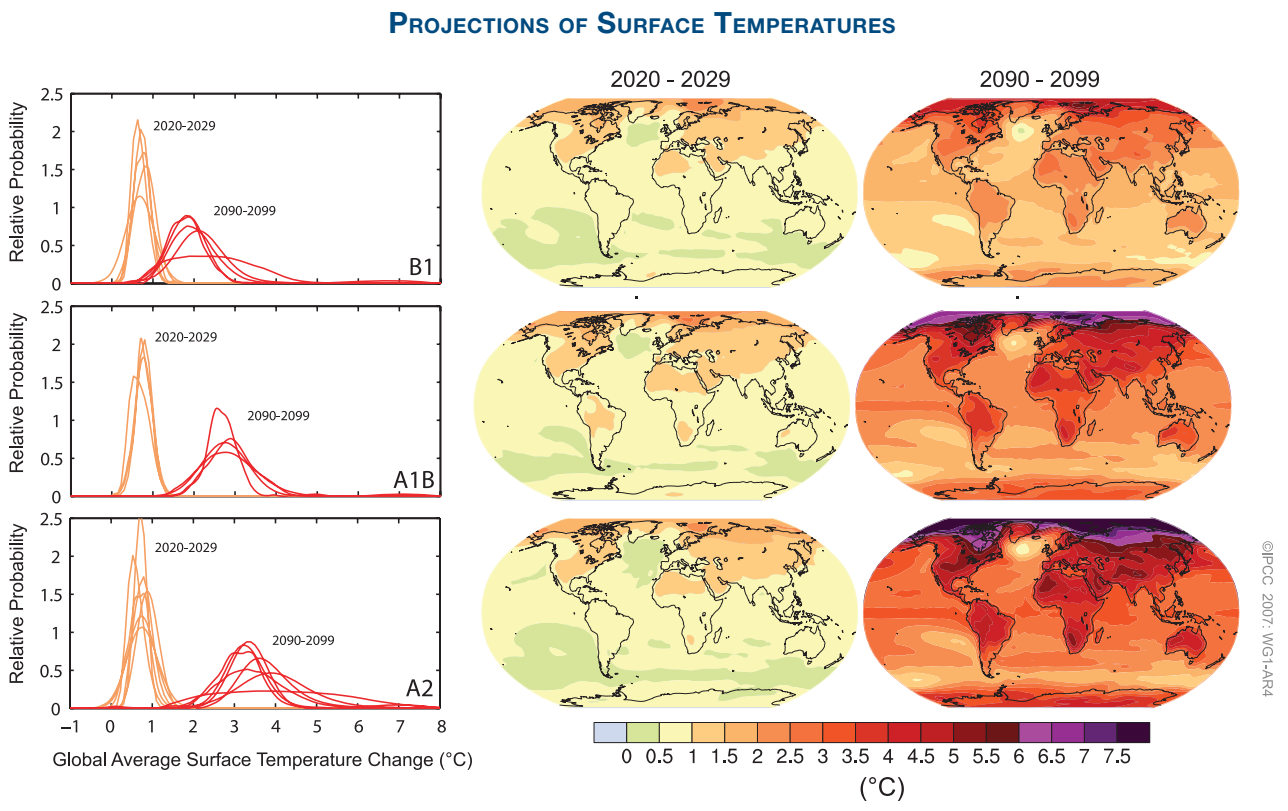


Figure SPM.6. *Projected surface temperature changes for the early and late 21st century relative to the period 1980–1999. The central and right panels show the AOGCM multi-model average projections for the B1 (top), A1B (middle) and A2 (bottom) SRES scenarios averaged over the decades 2020–2029 (centre) and 2090–2099 (right). The left panels show corresponding uncertainties as the relative probabilities of estimated global average warming from several different AOGCM and Earth System Model of Intermediate Complexity studies for the same periods. Some studies present results only for a subset of the SRES scenarios, or for various model versions. Therefore the difference in the number of curves shown in the left-hand panels is due only to differences in the availability of results. {Figures 10.8 and 10.28}*

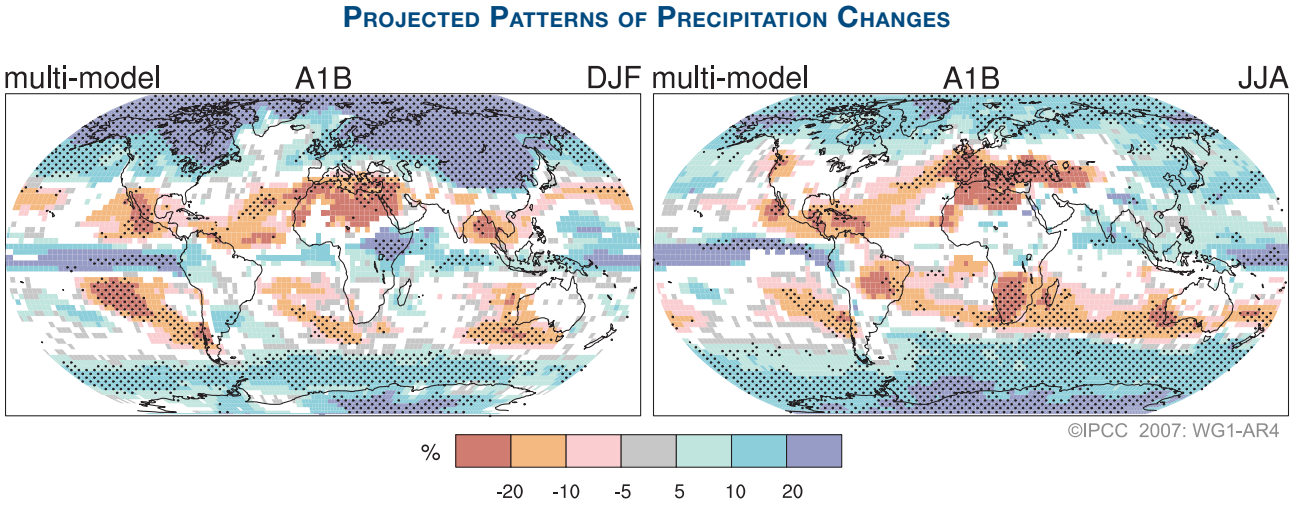


Figure SPM.7. *Relative changes in precipitation (in percent) for the period 2090–2099, relative to 1980–1999. Values are multi-model averages based on the SRES A1B scenario for December to February (left) and June to August (right). White areas are where less than 66% of the models agree in the sign of the change and stippled areas are where more than 90% of the models agree in the sign of the change. {Figure 10.9}*

- Extratropical storm tracks are projected to move poleward, with consequent changes in wind, precipitation and temperature patterns, continuing the broad pattern of observed trends over the last half-century. {3.6, 10.3}

- Since the TAR, there is an improving understanding of projected patterns of precipitation. Increases in the amount of precipitation are *very likely* in high latitudes, while decreases are *likely* in most subtropical land regions (by as much as about 20% in the A1B scenario in 2100, see Figure SPM.7), continuing observed patterns in recent trends. {3.3, 8.3, 9.5, 10.3, 11.2 to 11.9}

- Based on current model simulations, it is *very likely* that the meridional overturning circulation (MOC) of the Atlantic Ocean will slow down during the 21st century. The multi-model average reduction by 2100 is 25% (range from zero to about 50%) for SRES emission scenario A1B. Temperatures in the Atlantic region are projected to increase despite such changes due to the much larger warming associated with projected increases in greenhouse gases. It is *very unlikely* that the MOC will undergo a large abrupt transition during the 21st century. Longer-term changes in the MOC cannot be assessed with confidence. {10.3, 10.7}

Anthropogenic warming and sea level rise would continue for centuries due to the time scales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilised. {10.4, 10.5, 10.7}

- Climate-carbon cycle coupling is expected to add carbon dioxide to the atmosphere as the climate system warms, but the magnitude of this feedback is uncertain. This increases the uncertainty in the trajectory of carbon dioxide emissions required to achieve a particular stabilisation level of atmospheric carbon dioxide concentration. Based on current understanding of climate-carbon cycle feedback, model studies suggest that to stabilise at 450 ppm carbon dioxide could require that cumulative emissions over the 21st century be reduced from an average of approximately 670 [630 to 710] GtC (2460 [2310 to 2600] $GtCO_2$) to approximately 490 [375 to 600] GtC (1800 [1370 to 2200] $GtCO_2$). Similarly, to stabilise at 1000 ppm, this feedback could require that cumulative emissions be reduced from a model average of approximately 1415 [1340 to 1490] GtC (5190 [4910 to 5460] $GtCO_2$) to approximately 1100 [980 to 1250] GtC (4030 [3590 to 4580] $GtCO_2$). {7.3, 10.4}

- If radiative forcing were to be stabilised in 2100 at B1 or A1B levels[14] a further increase in global average temperature of about 0.5°C would still be expected, mostly by 2200. {10.7}

- If radiative forcing were to be stabilised in 2100 at A1B levels[14], thermal expansion alone would lead to 0.3 to 0.8 m of sea level rise by 2300 (relative to 1980–1999). Thermal expansion would continue for many centuries, due to the time required to transport heat into the deep ocean. {10.7}

- Contraction of the Greenland Ice Sheet is projected to continue to contribute to sea level rise after 2100. Current models suggest that ice mass losses increase with temperature more rapidly than gains due to precipitation and that the surface mass balance becomes negative at a global average warming (relative to pre-industrial values) in excess of 1.9°C to 4.6°C. If a negative surface mass balance were sustained for millennia, that would lead to virtually complete elimination of the Greenland Ice Sheet and a resulting contribution to sea level rise of about 7 m. The corresponding future temperatures in Greenland are comparable to those inferred for the last interglacial period 125,000 years ago, when palaeoclimatic information suggests reductions of polar land ice extent and 4 to 6 m of sea level rise. {6.4, 10.7}

- Dynamical processes related to ice flow not included in current models but suggested by recent observations could increase the vulnerability of the ice sheets to warming, increasing future sea level rise. Understanding of these processes is limited and there is no consensus on their magnitude. {4.6, 10.7}

- Current global model studies project that the Antarctic Ice Sheet will remain too cold for widespread surface melting and is expected to gain in mass due to increased snowfall. However, net loss of ice mass could occur if dynamical ice discharge dominates the ice sheet mass balance. {10.7}

- Both past and future anthropogenic carbon dioxide emissions will continue to contribute to warming and sea level rise for more than a millennium, due to the time scales required for removal of this gas from the atmosphere. {7.3, 10.3}

The Emission Scenarios of the IPCC Special Report on Emission Scenarios (SRES)[17]

A1. The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil-intensive (A1FI), non-fossil energy sources (A1T) or a balance across all sources (A1B) (where balanced is defined as not relying too heavily on one particular energy source, on the assumption that similar improvement rates apply to all energy supply and end use technologies).

A2. The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing population. Economic development is primarily regionally oriented and per capita economic growth and technological change more fragmented and slower than other storylines.

B1. The B1 storyline and scenario family describes a convergent world with the same global population, that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid change in economic structures toward a service and information economy, with reductions in material intensity and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social and environmental sustainability, including improved equity, but without additional climate initiatives.

B2. The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social and environmental sustainability. It is a world with continuously increasing global population, at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented towards environmental protection and social equity, it focuses on local and regional levels.

An illustrative scenario was chosen for each of the six scenario groups A1B, A1FI, A1T, A2, B1 and B2. All should be considered equally sound.

The SRES scenarios do not include additional climate initiatives, which means that no scenarios are included that explicitly assume implementation of the United Nations Framework Convention on Climate Change or the emissions targets of the Kyoto Protocol.

[17] Emission scenarios are not assessed in this Working Group I Report of the IPCC. This box summarising the SRES scenarios is taken from the TAR and has been subject to prior line-by-line approval by the Panel.

STATE OF CALIFORNIA
GOVERNOR'S OFFICE OF PLANNING AND RESEARCH

ARNOLD SCHWARZENEGGER
GOVERNOR

CYNTHIA BRYANT
DIRECTOR

April 13, 2009

Honorable Mike Chrisman
California Secretary for Natural Resources
Natural Resources Agency
1416 Ninth Street, Suite 1311
Sacramento, CA 95814

Re: Transmittal of the Governor's Office of Planning and Research's Proposed SB97 CEQA Guidelines Amendments to the Natural Resources Agency.

Dear Secretary Chrisman:

This packet contains the Governor's Office of Planning and Research's (OPR) proposed amendments to the CEQA Guidelines (Proposed Amendments) to address analysis and mitigation of the potential effects of greenhouse gas emissions. OPR developed the Proposed Amendments pursuant to Public Resources Code section 21083.05, which states in part:

> On or before July 1, 2009, the Office of Planning and Research shall prepare, develop, and transmit to the Resources Agency guidelines for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions as required by this division, including, but not limited to, effects associated with transportation or energy consumption.

In developing the Proposed Amendments, OPR actively sought the input, advice, and assistance of numerous interested parties and stakeholder groups. Over the past year and a half, OPR has met with representatives of numerous agencies and organizations to discuss the perspectives of the business community, the environmental community, local governments, non-governmental organizations, state agencies, public health officials, CEQA practitioners and legal experts. In addition, OPR took advantage of numerous regional and statewide conferences to raise awareness about CEQA and Greenhouse Gas Emissions among diverse audiences and to seek their input.

After publishing a preliminary draft on January 8, 2009, OPR continued to conduct extensive public outreach, including two public workshops, to receive input on the proposed amendments. Both public workshops were well attended, drawing over two hundred participants representing various California business interests, environmental

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organizations, local governments, attorneys and consultants. In addition to oral comments at its workshops, OPR also received over eighty written comment letters.

Some comments suggested additional amendments to the CEQA Guidelines. Other comments sought clarification on the proposed language in the amendments. OPR has incorporated those suggestions and clarifications to the extent possible. Some suggestions were not appropriate for inclusion, however, due to conflict with existing statutory authority and case law. The Proposed Amendments reflect OPR's effort to consider all viewpoints in a manner consistent with CEQA.

Summary of OPR's Proposed Amendments

Analysis of greenhouse gas emissions in a CEQA document presents unique challenges to lead agencies. Such analysis must be consistent with existing CEQA principles, however. Therefore, the Proposed Amendments suggest relatively modest changes to various portions of the existing CEQA Guidelines. Modifications address those issues where analysis of greenhouse gas emissions may differ in some respects from more traditional CEQA analysis. Other modifications are suggested to clarify existing law that may apply both to analysis of greenhouse gas emissions as well as more traditional CEQA analyses. Except where expressly stated to the contrary, OPR intends the Proposed Amendments to incorporate existing law. The incremental approach in the Proposed Amendments reflects Public Resources Code section 21083(f), which directs OPR to regularly review the Guidelines and propose amendments as necessary.

The Proposed Amendments recommend changes to or additions of fourteen sections of the existing Guidelines, as well as updates to Appendices F (Energy Conservation) and G (Environmental Checklist Form). A summary of the Proposed Amendments is below.

Determining Significance

A new section is proposed to assist lead agencies in determining the significance of the impacts of greenhouse gas emissions. (See section 15064.4.) Consistent with developing practice, this section urges lead agencies to quantify the greenhouse gas emissions of proposed projects where possible. In addition to quantification, this section recommends consideration of several other qualitative factors that may be used in the determination of significance.

This section evolved as a result of OPR's public outreach process. For example, a sentence has been added to the beginning of section 15064.4 to incorporate the standards of determining significance in section 15064, and to reiterate that the determination of significance calls for the lead agency to exercise its judgment. Further, the phrase "associated with" in the preliminary draft was replaced by "resulting from" to conform to existing CEQA law that requires analysis only of impacts caused by the project. The change is also necessary to avoid an implication that a "life-cycle" analysis is required.

Descriptions of emissions were drafted to be more general to capture all relevant emissions resulting from a project and to avoid any suggestion that lead agencies should only consider emissions related to traffic and energy use, for example. Similarly, lead agencies are encouraged to consider the full range of project features that may increase or decrease greenhouse gas emissions as compared to the existing setting.

Regarding the use of thresholds, section 15064.4 confirms that if it chooses to rely on a threshold developed by some other entity, the lead agency must determine that an existing threshold is appropriate for the project.

Finally, some comments suggested that the California Air Resources Board's Scoping Plan, by itself, provides sufficient CEQA analysis of greenhouse gas emissions, and that projects that are consistent with the Scoping Plan should not require further analysis. While specific regulations that will be developed to achieve the targets and goals set in the Scoping Plan might be used, consistent with the standards in existing section 15064(h)(3), in a cumulative impacts analysis, the Scoping Plan itself is not a regulatory instrument. Therefore, the Proposed Amendments have been revised to clarify that consistency with the Scoping Plan, by itself, is not a sufficient basis to determine that a project's emissions of greenhouse gases is not cumulatively considerable.

Thresholds of Significance

A new subdivision to section 15064.7 is proposed to clarify that in developing thresholds of significance, a lead agency may appropriately look to thresholds developed by other public agencies, including the California Air Resources Board's recommended CEQA Thresholds, or suggested by other experts, such as the California Air Pollution Control Officers Association, so long as any threshold chosen is supported by substantial evidence. (See section 15064.7(c).)

Statement of Overriding Considerations

A new subdivision was added to clarify that the benefits of a project that may be considered in a statement of overriding considerations may include not just local benefits, but also regional or statewide benefits. (See section 15093(d).) OPR does not intend the addition to section 15093 to encourage local versus regional considerations or to imply that regional considerations are more important than local considerations. Rather, a lead agency remains free to consider a broad range of factors in determining whether a project's benefits override its adverse impacts.

Mitigation

A new subdivision was added to assist lead agencies in determining methods to mitigate the effects of greenhouse gas emissions. (See section 15126.4(c).) This section emphasizes that the general standards for mitigation in subdivision (a) of section 15126.4 apply to mitigation of greenhouse gas emissions. Language in this

subdivision intentionally refers to emissions generally to avoid any suggestion that a lead agency need only mitigate for particular emissions, from energy and fossil fuel consumption for example. The subdivision does direct lead agencies to Appendix F, however, for mitigation measures that may reduce a project's energy use.

Additionally, this new subdivision emphasizes compliance with a plan among the list of potential mitigation measures to emphasize the advantages of programmatic planning. However, to qualify as mitigation, specific measures from an existing plan must be identified and incorporated into the project; general compliance with a plan, by itself, is not mitigation. Finally, this subdivision reiterates that mitigation for planning level decisions may include the development of specific measures to be implemented on a project-by-project basis.

Cumulative Impacts

A new subdivision is proposed to emphasize that the effects of greenhouse gas emissions are cumulative, and should be analyzed in the context of CEQA's requirements for cumulative impacts analysis. (See section 15130(f).) The new subdivision has been revised from its preliminary draft in response to comments and to focus on a project's incremental contribution to an overall cumulative effect. The revision also clarifies that a summary of projections approach may be used in an analysis of greenhouse gas emissions.

Plans, Incorporation by Reference and Tiering

Given that impacts resulting from greenhouse gas emissions are cumulative in nature, significant advantages may result from analyzing such impacts on a programmatic level. If analyzed properly, later projects may then tier, incorporate by reference, or otherwise rely on that programmatic analysis. Thus, several amendments were proposed to identify plans that may provide some level of analysis of greenhouse gas emissions, and to suggest how those plans may be used in later CEQA analyses. Changes to that effect were recommended in sections 15064(h)(3) (determining the significance of cumulative impacts), 15125 (environmental setting), 15130(b)(1)(B) (using a summary of projections in a cumulative impacts analysis), 15130(d) (plans that may be used in a cumulative impacts analysis), 15150 (incorporation by reference), 15152 (tiering), and 15183 (projects consistent with a community plan or zoning).

In response to public comments, the Proposed Amendments clarify which plans are appropriate for specific uses throughout the Guidelines. For example, while regional blueprint plans are appropriately discussed as part of the Environmental Baseline in section 15125, such plans would not be appropriately considered in section 15064(h)(3), which permits a lead agency to determine that cumulative impacts are less than significant due to compliance with certain plans.

Further, a new proposed section, 15183.5, will provide additional guidance on tiering of greenhouse gas emissions analyses where environmental impact reports for plans

addressing greenhouse gas emissions have been prepared. That section will also describe the characteristics of greenhouse gas emissions reduction plans that may be used in a tiering context.

Definition

A definition of "greenhouse gas" was added in section 15364.5.

Energy Analysis

Appendix F was revised to clarify that EIRs must specifically consider a project's energy use and efficiency potential. During its outreach efforts on the Proposed Amendments, OPR received some comments referring to the phrase "life-cycle analysis." OPR finds, however, that the term is capable of different interpretations, and its usage in the Guidelines may potentially create confusion. Therefore, references to a "life-cycle analysis" in the existing Appendix F have been revised or eliminated for clarity.

Environmental Checklist

Questions relating to the effects of greenhouse gas emissions were added to the Appendix G Environmental Checklist. Other questions were revised to encourage consideration of forestry impacts and to clarify the proper focus of a traffic impacts analysis. OPR originally proposed deletion of level of service (LOS) references in the Checklist questions related to traffic and transportation. After considering public input, OPR recommends inclusion of revised questions in the Environmental Checklist that recognize the following: (a) the necessity of assessing traffic impacts on intersections, streets, highways and freeways, (b) a lead agency's discretion to choose methodology, including LOS, to assess traffic impacts, (c) existing requirements in Congestion Management Programs, General Plans, ordinances, and elsewhere, and (d) traffic impacts include impacts to pedestrian, non-vehicular and mass-transit circulation.

Miscellaneous

Finally, several minor corrections and clarifications were added in sections 15065, 15086, and 15126.2.

Next Steps

This submittal to the Natural Resources Agency will be posted on the OPR website. The Natural Resources Agency will then begin a formal rulemaking process to certify and adopt the amendments as part of the state regulations implementing CEQA, in accordance with the requirements of the Administrative Procedures Act (APA).

The Natural Resources Agency's rulemaking process will include additional opportunities for public involvement, including comment periods and public hearings.

As required by the APA, the Resources Agency will respond to all public comments in writing before certifying and adopting the amendments.

The rulemaking process will be completed by January 1, 2010, as required by Public Resources Code section 21083.05(b). Names of interested parties on OPR's contact list for the SB 97 CEQA Guidelines process will automatically be placed on the Natural Resources Agency's contact list and will receive notices from the Natural Resources Agency regarding the 2009 CEQA rulemaking.

Please do not hesitate to contact me if I can provide further assistance.

Sincerely,



Cynthia Bryant
Director

ATTACHMENT E

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Draft Guidance Document – Interim CEQA Greenhouse Gas (GHG) Significance Threshold

October 2008

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P R E F A C E

This Draft *Guidance Document – Interim CEQA Greenhouse Gas (GHG) Significance Threshold* document contains the proposed interim GHG significance threshold, rationale for developing the threshold, and details of the working group meetings and represents a work-in-progress of staff's efforts to date. This document will be updated as more information becomes available. For the staff recommendation to the Governing Board at the December 5, 2008 public hearing, please refer to Attachment A of Agenda Item Number 31.

Finally, to facilitate identifying changes to this Guidance Document since its release in October 2008, added text is underlined and deleted text is denoted with ~~strikethrough~~ text.

LIST OF ACRONYMS AND ABBREVIATIONS

List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
AB 32	Assembly Bill 32 Global Warming Solutions Act of 2006
AER	Annual Emission Reporting
AG	Attorney General
ARB	Air Resources Board
BACT	Best Available Control Technology
BARCT	Best Available Retrofit Control Technology
BAU	Business as Usual
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resource Board
CAT	Climate Action Team
CCAR	California Climate Action Registry
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CPUC	California Public Utilities Commission
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
FY	Fiscal Year
GHG	Greenhouse Gas
GGRP	Greenhouse Gas Reduction Plan
GP	General Plan
GWP	Global Warming Potential
IGR	Intergovernmental Review
IPCC	International Panel on Climate Change
ITE	Institute of Transportation Engineers
km	Kilometer
LNG	Liquefied Natural Gas
MMBTU	Million British Thermal Units
MND	Mitigated Negative Declaration
MMT CO_2e	Million Metric Tons Carbon Dioxide Equivalent
MW	Megawatts
N_2O	Nitrous Oxide
ND	Negative Declaration
NO_X	Oxides of Nitrogen
OPR	State Office of Planning and Research
PFC	Perfluorocarbon

List of Acronyms and Abbreviations (Concluded)

Acronym/ Abbreviation	Definition
PM	Particulate Mater
ROG	Reactive Organic Gas
RPS	Renewable Portfolio Standards
S-3-05	Executive Order S-3-05
SB	Senate Bill
SCAQMD	South Coast Air Quality Management District
SIP	State Implementation Plan
SOx	Sulfur Oxides
TAC	Toxic Air Contaminants
URBEMIS	Urban Emissions Model
VMT	Vehicle Miles Traveled

CHAPTER 1

INTRODUCTION AND EXECUTIVE SUMMARY

Introduction
Purpose of This Guidance Document
California Environmental Quality Act and GHGs
Legal Authority
Contents of This Guidance Document

INTRODUCTION

The California Environmental Quality Act (CEQA) requires public agencies in California to analyze potential adverse impacts for proposed projects undertaken by a public agency, funded by a public agency, and requiring discretionary approval by a public agency. The fundamental purposes of CEQA are to inform governmental decision-makers and the public about the significant environmental effects of proposed activities, identify ways to avoid or significantly reduce environmental damage, use feasible alternatives or mitigation measures to avoid significant damage, and disclose to the public why a governmental agency approved a project if significant effects are involved (CEQA Guidelines §15002[a]). To disclose potential adverse impacts from a proposed project, pursuant to CEQA lead agencies typically prepare multidisciplinary environmental impact analysis and make decisions based on the analysis regarding the environmental effects of the proposed project (CEQA Guidelines §15002[a]).

In the past, air quality analyses tended to focus on potential adverse impacts from criteria pollutants and toxic air contaminants. Subsequent to the adoption of Assembly Bill (AB) 32 – The California Global Warming Solutions Act of 2006, lead agencies have increasingly faced legal challenges to their CEQA documents for failure to analyze greenhouse gases (GHGs) or making a determination of significance regarding GHG emission impacts.

Greenhouse gases are those gases that have the ability to trap heat in the atmosphere, a process that is analogous to the way a greenhouse traps heat. GHGs may be emitted as a result of human activities as well as through natural processes. As a result of human activities, such as electricity production, vehicle use, etc., GHGs have been accumulating in the earth's atmosphere at a faster rate than has occurred historically, i.e., prior to the Industrial Age starting approximately 150 years ago. Increasing GHG concentrations in the atmosphere are leading to global climate change.

The Intergovernmental Panel on Climate Change (IPCC) provided the first unequivocal evidence that global climate temperatures are increasing (2007a). Further, the primary driver of global climate change is increased emissions of GHGs due to human activities. According to the IPCC, there is very high confidence, based on more evidence from a wider range of species, that recent warming is strongly affecting terrestrial, marine, freshwater biological systems.

Carbon dioxide (CO2) is the most important anthropogenic GHG because it comprises the majority of total GHG emissions emitted per year and it is very long-lived in the atmosphere. Annual emissions of CO2 have increased approximately 80 percent between 1970 and 2004. In addition to CO2, other GHG pollutants emitted directly as a result of human activities include methane (CH4), nitrous oxide (N2O) and halocarbons (a group of gases containing fluorine, chlorine or bromine). Without changes in current climate change mitigation policies and related sustainable

development practices, GHG emissions and global climate temperatures will continue to increase.

To prevent or minimize further increases in global temperatures resulting from increases in GHG emissions due to human activities, it is necessary to stabilize the concentration of GHGs in the atmosphere. Stabilizing GHGs in the atmosphere can only occur through reducing GHG emissions. Without further reductions in GHGs, increased global temperatures will surpass humans' and ecosystems' ability to adapt to these changing conditions (IPCC, 2007b).

In response to the increasing body of evidence that GHGs will continue to affect global climate, Governor Schwarzenegger issued executive order (EO S-3-05), which established the following greenhouse gas emission reduction targets for California: by 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; by 2050, reduce GHG emissions to 80 percent below 1990 levels.

Subsequent to the Governor's issuance of EO S-3-05, the California State Legislature adopted Assembly Bill (AB) 32 – The California Global Warming Solutions Act of 2006. With the adoption of AB 32, the California State Legislature recognized the growing concern regarding changes to global climate resulting from increasing emissions of greenhouse gases (GHGs). AB 32 establishes a cap on statewide greenhouse gas emissions and sets forth the regulatory framework to achieve the corresponding reduction in statewide emissions levels. Specifically, (AB 32) recognizes the serious threat to the "economic wellbeing, public health, natural resources, and the environment of California" that results from global warming. Consequently, AB 32 mandates a significant reduction in GHGs in order to contribute to efforts to stabilize atmospheric concentrations of GHGs. Under AB 32, greenhouse gases are defined as: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

In general, there is currently an absence of regulatory guidance with regard to analyzing GHG emission impacts in CEQA documents. Similarly, no public agency in California has formally adopted GHG significance thresholds. Recognizing the absence of guidance regarding analyzing and determining the significance of GHGs, the California Air Pollution Control Officers Association (CAPCOA) prepared a White Paper reviewing policy choices, analytical tools, and mitigation strategies for GHGs. In particular, the White Paper identifies a number of options for establishing GHG significance thresholds, but makes no formal recommendation of one approach over another.

Air districts typically act in an advisory capacity to local governments in establishing the framework for environmental review of air pollution impacts under CEQA. This may include recommendations regarding significance thresholds, analytical tools to estimate emissions and assess impacts, and mitigations for potentially significant impacts. Although districts will also address some of these issues on a project-specific basis as responsible agencies, they may provide general guidance to local governments on these issues.

Because of its expertise in establishing air quality analysis methodologies and comprehensive efforts to establish regional and localized significance thresholds for criteria pollutants, local public agencies have asked South Coast Air Quality Management District (SCAQMD) for guidance in quantifying GHG impacts and recommending GHG significance thresholds to assist them with determining whether or not GHG impacts in their CEQA documents are significant. As a result, SCAQMD staff has received requests from a number of public agencies and other stakeholders to provide guidance on analyzing GHG impacts and establishing a GHG significance threshold. In response to these requests from the various stakeholders, SCAQMD established a stakeholder working group to receive input on establishing a GHG significance threshold. In the meantime, SCAQMD staff has joined many other stakeholders urging CARB to establish a statewide threshold for GHGs. In the absence of a statewide threshold, SCAQMD staff will recommend its interim approach to the Governing Board for consideration and it will also become the SCAQMD's input to the statewide process.

PURPOSE OF THIS GUIDANCE DOCUMENT

The purpose of this Guidance Document, therefore, is to provide information on GHG legislation relative to CEQA, a brief summary of the Working Group process, development of the resulting staff-recommended interim GHG significance threshold proposal, and how to use it. This Guidance Document also provides information on the SCAQMD's authority to establish a GHG significance threshold pursuant to CEQA and some background information on GHGs and global climate change. This Guidance Document also discusses future efforts to further refine the interim GHG significance threshold as necessary, includes recommendations for analyzing GHG impacts using current modeling tools, and describes measures to mitigate GHG emission impacts.

CALIFORNIA ENVIRONMENTAL QUALITY ACT AND GHGS

- California Attorney General's Office

Subsequent to adopting AB 32, the California Attorney General's Office determined that GHG emissions contributing to global climate change also contribute to potential adverse environmental impacts that should be evaluated pursuant to the California Environmental Quality Act (CEQA). The Attorney General's Office has submitted numerous comment letters to lead agencies on their CEQA documents for failure to analyze GHG emissions, failure to make a significance determination, and failure to implement feasible mitigation measures to reduce GHG emissions to the maximum extent feasible.

For example, the California Attorney General, on behalf of the people of California, filed a legal challenge against the County of San Bernardino for failure to analyze "reasonably foreseeable" GHG emissions in the CEQA document prepared for its

General Plan update. The County reached a settlement with the Attorney General by committing to developing a GHG inventory and a plan for reducing GHGs.

Similarly, the California Attorney General submitted comments on the CEQA document for a refinery in northern California. Although GHG emissions were quantified, the Attorney General cited the failure of the lead agency to make a determination of significance relative to GHG emissions stating, "[E]ven if there is no established threshold in law or regulation, lead agencies are obligated by CEQA to determine significance. Neither CEQA, nor the regulations, authorize reliance on the lack of an agency-adopted standard as the basis for determining that a project's potential cumulative impact is not significant." In other words, the absence of a threshold does not in any way relieve lead agencies of their obligations to address GHG emissions from projects under CEQA. By not concluding whether or not a project is significant, the lead agency may be avoiding its responsibility to implement GHG mitigation measures.

- Senate Bill (SB) 97 – CEQA: Greenhouse Gas Emissions

In August 2007, Governor Schwarzenegger signed into law Senate Bill (SB) 97 – CEQA: Greenhouse Gas Emissions stating, "This bill advances a coordinated policy for reducing greenhouse gas emissions by directing the Office of Planning and Research (OPR) and the Resources Agency to develop CEQA guidelines on how state and local agencies should analyze, and when necessary, mitigate greenhouse gas emissions." Specifically, SB 97 requires OPR, by July 1, 2009, to prepare, develop, and transmit to the Resources Agency guidelines for the feasible mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions, as required by CEQA, including, but not limited to, effects associated with transportation or energy consumption. The Resources Agency would be required to certify and adopt those guidelines by January 1, 2010. OPR would be required to periodically update the guidelines to incorporate new information or criteria established by the State Air Resources Board pursuant to the California Global Warming Solutions Act of 2006. SB 97 also identifies a limited number of types of projects that would be exempt under CEQA from analyzing GHG emissions. Finally, the legislation will be repealed on January 1, 2010.

- Office of Planning and Research Technical Advisory

Consistent with SB 97, on June 19, 2008, OPR released its *Technical Advisory on CEQA and Climate Change*, which was developed in cooperation with the Resources Agency, the California Environmental Protection Agency (Cal/EPA), and the California Air Resources Board (CARB). According to OPR, the *Technical Advisory* offers the informal interim guidance regarding the steps lead agencies should take to address climate change in their CEQA documents, until CEQA guidelines are developed pursuant to SB 97 on how state and local agencies should analyze, and when necessary, mitigate greenhouse gas emissions.

According to OPR, lead agencies should determine whether greenhouse gases may be generated by a proposed project, and if so, quantify or estimate the GHG emissions by

type and source. Second, the lead agency must assess whether those emissions are individually or cumulatively significant. When assessing whether a project's effects on climate change are "cumulatively considerable" even though its GHG contribution may be individually limited, the lead agency must consider the impact of the project when viewed in connection with the effects of past, current, and probable future projects. Finally, if the lead agency determines that the GHG emissions from the project as proposed are potentially significant, it must investigate and implement ways to avoid, reduce, or otherwise mitigate the impacts of those emissions.

- SB 375 (Steinberg) Transportation, Land Use, and the California Environmental Quality Act (CEQA)

On September 30, 2008, Governor Schwarzenegger signed into law SB 375 (Steinberg). SB 375 focuses on housing and transportation planning decisions to reduce fossil fuel consumption and conserve farmlands and habitat. This legislation is important to achieving AB 32 goals because greenhouse gas emissions associated with land use, which includes transportation, are the single largest sector of emissions in California. Further, SB 375 provides a path for better planning by providing incentives to locate housing developments closer to where people work and go to school, allowing them to reduce vehicle miles traveled (VMT) every year. The following bullet points summarize some of the main provisions of the bill.

- Require the regional governing bodies in each of the state's major metropolitan areas to adopt, as part of their regional transportation plan, a "sustainable community strategy" that will meet the region's target for reducing GHG emissions. These strategies would get people out of their cars by promoting smart growth principles such as: development near public transit; projects that include a mix of residential and commercial use; and projects that include affordable housing to help reduce new housing developments in outlying areas with cheaper land and reduce vehicle miles traveled (VMT).

- Create incentives for implementing the sustainable community strategies by allocating federal transportation funds only to projects that are consistent with the emissions reductions.

- Provide various forms of CEQA relief by allowing projects that are shown to conform to the preferred sustainable community strategy through the local general plans (and therefore contribute to GHG reduction) to have a more streamlined environmental review process. Specifically, SB 375 will change CEQA in two ways:

  - If a development is consistent with the sustainable community's strategy and incorporates any mitigation measures required by a prior EIR, then the environmental review does not have to consider: a) growth-inducing impacts, or b) project-specific or cumulative impacts from cars on global warming or the regional transportation network.

- A narrowly-defined group of "transit priority projects" will be exempt from CEQA review.

LEGAL AUTHORITY

CEQA Guidelines §15022(a) states that a public agency shall adopt objectives, criteria, and specific procedures consistent with CEQA and these [State] Guidelines for administering its responsibilities under CEQA. CEQA Guidelines §15022(d) states further, "In adopting procedures to implement CEQA, a public agency may adopt the State CEQA Guidelines through incorporation by reference. The agency may then adopt only those specific procedures or provisions described in subsection [15022] (a) which are necessary to tailor the general provisions of the guidelines to the specific operations of the agency." At the December 11, 1998 Public Hearing the SCAQMD's Governing Board formally incorporated by reference the State CEQA Guidelines as the implementing guidelines for the SCAQMD's CEQA program. Adopting GHG significance thresholds would be consistent with CEQA Guidelines §15022 provision to tailor a public agency's implementing guidelines by adopting criteria relative to the specific operations of the SCAQMD.

Specifically with regard to thresholds of significance, CEQA Guidelines §15064.7(a) states, "Each public agency is encouraged to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects." Subsection (b) of the same section states further, "Thresholds of significance to be adopted for general use as part of the lead agency's environmental review process must be adopted by ordinance, resolution, rule or regulation, and developed through a public review process and be supported by substantial evidence." Staff's recommended GHG significance threshold has undergone a public review process as part of stakeholder working group meetings that are open to the public. This Guidance Document provides the substantial evidence relative to the methodology for developing the interim GHG significance threshold. After completion of the public process, the proposed interim GHG significance threshold will be brought to the SCAQMD's Governing Board at a public meeting, where it will be considered for adoption by resolution, consistent with CEQA Guidelines §15064.7(b). Staff's proposed interim GHG significance threshold is a recommendation only for lead agencies and not a mandatory requirement. The GHG significance threshold may be used at the discretion of the local lead agency. However, if adopted the SCAQMD will use the interim GHG significance threshold for projects where it is the lead agency.

- Considerations When Establishing Significance Thresholds

No significance thresholds for GHG emissions have been developed, adopted, or endorsed statewide or at the local level[1]. Air districts have primary authority under

[1] In response to comments submitted by the Attorney General's Office on a dairy project, the San Joaquin Valley Air Pollution Control District (SJVAPCD) identified a significance threshold of 38,477 metric tons of

state law for "control of air pollution from all sources, other than emissions from motor vehicles" (H&SC §40000). The term air contaminant or "air pollutant" is defined extremely broadly, to mean "any discharge, release, or other propagation into the atmosphere" and includes, but is not limited to, soot, carbon, fumes, gases, particulate matter, etc. Greenhouse gases and other global warming pollutants such as black carbon would certainly be included in this definition. The U.S. Supreme Court held in Massachusetts v. EPA 549 U.S. 497 (2009) that greenhouse gases were clearly within the Federal Clean Air Act's broad definition of air pollutants. Therefore, air districts have the authority to regulate global warming pollutants primarily from non-vehicular sources, while pursuant to AB 32 CARB has authority over a wide range of sources, including vehicular sources.

Appendix G of the CEQA Guidelines provides a checklist of suggested environmental topics that should be addressed in a CEQA document. Questions under each environmental topic area are designed to elicit information on whether a project has the potential to generate significant adverse environmental impacts to that environmental topic area. However, neither the CEQA statutes nor the implementing Guidelines discuss or identify thresholds of significance or particular methodologies for performing an impact analysis. These tasks are left to a lead agency's judgment and discretion, based upon factual data and guidance from regulatory agencies and other sources where available and applicable.

The determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved, based to the extent possible on scientific and factual data. An ironclad definition of significant effect is not always possible because the significance of an activity may vary with the setting. For example, an activity which may not be significant in an urban area may be significant in a rural area (CEQA Guidelines §15064(b)). Further, in evaluating the significance of the environmental effect of a project, the Lead Agency shall consider direct physical changes in the environment which may be caused by the project and reasonably foreseeable indirect physical changes in the environment which may be caused by the project (§15064(d)). Significance conclusions must be based on substantial evidence, which includes facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts (CEQA Guidelines §15064(f)(5)).

Each public agency is encouraged to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects. A threshold of significance is essentially a regulatory standard or set of criteria that represent the level at which a lead agency finds a particular environmental effect of a project to be significant. Specifically, a threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant

carbon dioxide equivalent per year (MT CO2eq./yr). According to SJVAPCD staff, the agency currently has no plans to formally adopt this significance threshold through a public process.

by the agency and compliance with which means the effect normally will be determined to be less than significant (§15064.7(a)).

Even in the absence of clearly defined significance thresholds for GHG emissions, the California Attorney General has advised that such emissions from CEQA projects must be disclosed and mitigated to the extent feasible whenever the lead agency determines that the project contributes to a significant, cumulative climate change impact.

CONTENTS OF THIS GUIDANCE DOCUMENT

The following subsections provide brief summaries of the chapters contained in this guidance document.

- **Summaries of Chapter 1**

Chapter 1 is the introductory chapter of this document that contains general background information on GHGs and the determination that GHGs must be analyzed in CEQA documents. There is also information on CEQA legislation related to GHGs and global climate change. Finally, the chapter contains information on the legal authority that allows the SCAQMD to adopt significance thresholds for the purpose of determining the severity of impacts analyzed in CEQA documents

- **Summaries of Chapter 2**

Chapter 2 contains more detailed background information on GHG emissions relative to global climate change, both internationally and nationally. This chapter also provides more detailed information on legislation to reduce GHG house gas emissions, e.g., Assembly Bill 32 – the Global Warming Solutions Act of 2006, etc. Finally, Chapter 2 contains information on early guidance on evaluating GHG emissions in CEQA documents.

- **Summaries of Chapter 3**

Chapter 3 contains information on the working group established by the SCAQMD to provide feedback to staff on the development of an interim GHG significance threshold. The chapter also includes discussions on considerations in establishing an interim GHG significance threshold and describes the current staff proposal for an interim GHG significance threshold.

- **Summaries of Chapter 4**

Chapter 4 contains general recommendations for analyzing GHG emissions in CEQA documents.

- Summaries of Chapter 5

In Chapter 5 it is assumed that the SCAQMD Governing Board will adopt staff's proposed interim GHG significance threshold. Therefore, this chapter discusses future action items, including outreach to interested stakeholders, compiling lists of applicable GHG design features and mitigation measures, and periodic review and update, as necessary of the interim GHG significance threshold.

CHAPTER 2

BACKGROUND INFORMATION ON GHGS

General Background Information

Legislative Background – California

Initial Guidance on Evaluating GHGs Pursuant to CEQA

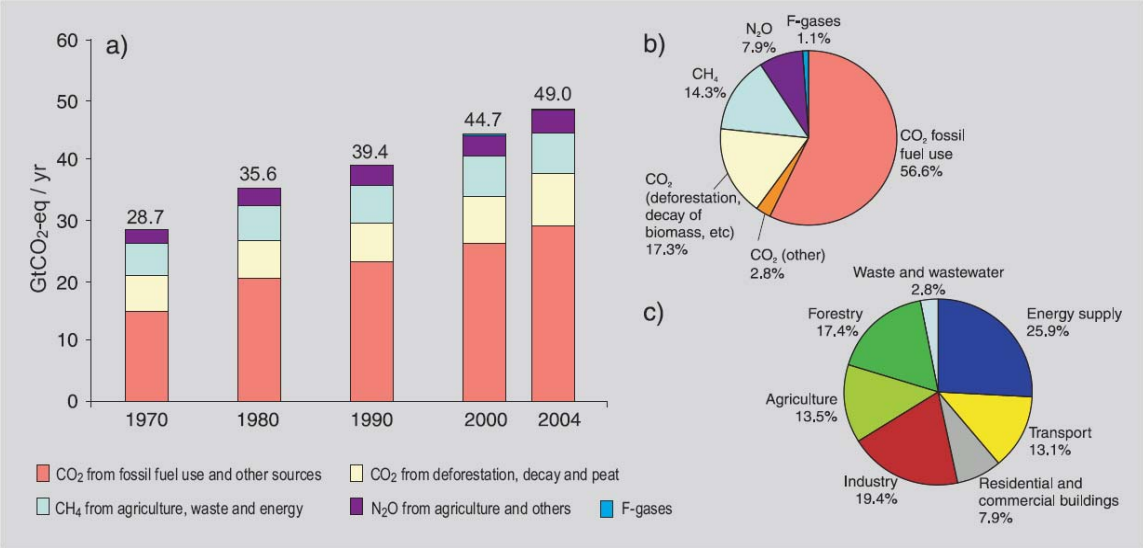
GENERAL BACKGROUND INFORMATION ON GHGS

- Intergovernmental Panel on Climate Change

In the last few years information and data have been compiled that demonstrate unequivocally that increases in average global air and ocean temperatures are occurring (IPCC, 2007a). For example, 11 of the last 12 years (1995-2006) rank among the 12 warmest years in the instrumental record of global surface temperature (since 1850). The temperature increase is widespread over the globe and is greater at higher northern latitudes. Further, increases in sea level are consistent with global warming. For example, global average sea level rose at an average rate of 1.8 [1.3 to 2.3]mm per year over 1961 to 2003 and at an average rate of about 3.1 [2.4 to 3.8]mm per year from 1993 to 2003. According to the IPCC (2007b), there is very high confidence, based on more evidence from a wider range of species, that recent warming is strongly affecting terrestrial, marine, and freshwater biological systems.

One of the major drivers in global climate change has been directly linked to the increase in greenhouse gas (GHG) emissions due to human activities worldwide (Figure 2-1). Carbon dioxide (CO2) is the most important anthropogenic GHG. Annual CO2 emissions have increased approximately 80 percent between 1970 and 2004 (IPCC, 2007b)

Figure 2-1
Global Anthropogenic GHG Emissions



Source – IPCC, 2007b: (a) Global annual emissions of anthropogenic GHGs from 1970 to 2004.5 (b) Share of different anthropogenic GHGs in total emissions in 2004 in terms of CO2-eq. (c) Share of different sectors in total anthropogenic GHG emissions in 2004 in terms of CO2-eq. (Forestry includes deforestation.) {WGIII Figures TS.1a, TS.1b, TS.2b}

Human activities have been responsible for substantial increases in four long-lived GHGs, including: CO2, methane (CH4), nitrous oxide (N2O) and halocarbons (a group of gases

containing fluorine, chlorine or bromine). Global increases in CO2 concentrations are due primarily to fossil fuel use, with land-use change providing another significant but smaller contribution. It is very likely that the observed increase in CH4 concentration is predominantly due to agriculture and fossil fuel use. The increase in N2O concentration is primarily due to agriculture (IPCC, 2007).

According to the IPCC (2007), for the next couple of decades global temperatures are expected to rise approximately 0.2^{o} C per decade under a variety of scenarios. Further, global temperatures are expected to continue for centuries as a result of human activities due to the time scales associated with climate processes and feedbacks, even if GHG concentrations are stabilized. As a result, based on the current understanding of climate-carbon feedback, model studies show that substantial GHG emission reductions are necessary to avoid substantial increases in global air and ocean temperatures.

LEGISLATIVE BACKGROUND – CALIFORNIA

California has taken a leadership role in not only recognizing the future impacts to global climate change from anthropogenic sources of GHG emissions, but in establishing policies and adopting laws to substantially reduce GHG emissions by 2050. In addition to the GHG legislation related to CEQA described in Chapter 1, California has adopted the following policies and laws that specifically address reducing GHG emissions.

- Governor Schwarzenegger's Executive Order (June 2005)

In June 2005, Governor Arnold Schwarzenegger signed Executive Order (EO) S-3-05, which establishes greenhouse gas emission reduction targets in response to projected increases in global air and ocean temperatures. Specifically, EO S-3-05 establishes the following three GHG emission reduction targets:

- Reduce GHG emissions to 2000 emission levels by 2010;
- Reduce GHG emissions to 1990 emission levels by 2020; and
- Reduce GHG emissions to 80 percent below 1990 levels by 2050.

Further, EO S-3-05 charges the California Environmental Protection Agency (CalEPA) secretary to coordinate with the Secretary of the Business, Transportation and Housing Agency, Secretary of the Department of Food and Agriculture, Secretary of the Resources Agency, Chairperson of the CARB, Chairperson of the Energy Commission and President of the Public Utilities Commission to develop a Climate Action Plan. EO S-3-05 also charges the Secretary of CalEPA with the oversight of efforts to meet the above GHG emission reduction targets and the responsibility to prepare biannual reports on progress in meeting the GHG emission reduction targets.

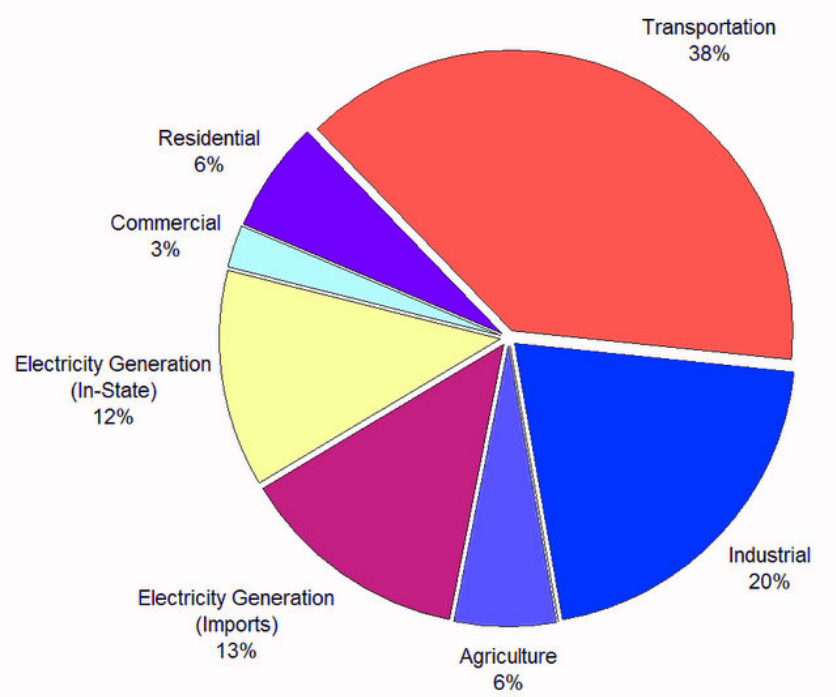
- **Global Warming Solutions Act of 2006 (Assembly Bill (AB) 32)**

The Global Warming Solutions Act of 2006 (AB 32) was adopted by the California State Legislature in 2006. AB 32 assigns CARB the responsibilities of monitoring and reducing GHG emissions. Specifically, AB 32 requires CARB to:

- Establish a statewide greenhouse gas emissions cap for 2020, based on 1990 emissions, by January 1, 2008;
- Adopt mandatory reporting rules for significant sources of greenhouse gases by January 1, 2009;
- Adopt a plan by January 1, 2009, indicating how emission reductions will be achieved from significant greenhouse gas sources via regulations, market mechanisms and other actions;
- Adopt regulations by January 1, 2011, to achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas, including provisions for using both market mechanisms and alternative compliance mechanisms;
- Convene an Environmental Justice Advisory Committee and an Economic and Technology Advancement Advisory Committee to advise CARB;
- Ensure public notice and opportunity for comment for all CARB actions;
- To adopt rules for "sources" including non-vehicular; and
- Prior to imposing any mandates or authorizing market mechanisms, CARB must evaluate several factors, including but not limited to impacts on California's economy, the environment and public health; equity between regulated entities; electricity reliability; conformance with other environmental laws, and must ensure that the rules do not disproportionately impact low-income communities.

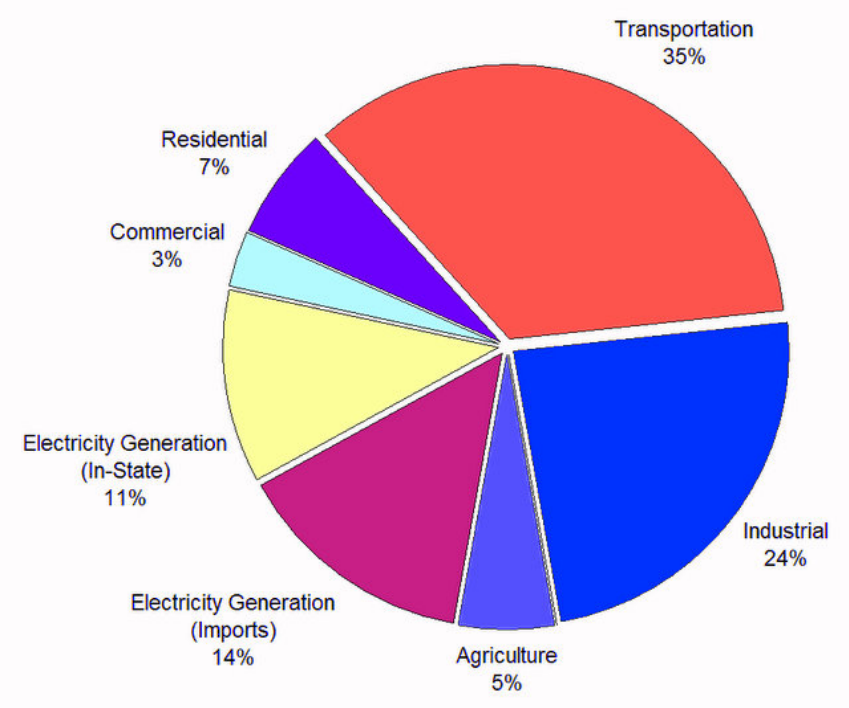
According to the schedule of milestones laid out in AB 32, CARB has made progress in the following areas. Consistent with AB 32's requirement to establish a GHG emission inventory, in December 2007 CARB adopted the California Greenhouse Gas Emission Inventory. The Inventory accounts for all GHG emissions within the state of California and supports the AB 32 Climate Change Program. Figure 2-2 shows CARB's inventory for the year 2004. The Inventory also serves as the basis for developing future year GHG emission forecasts necessary to support measure development and Scoping Plan recommendations. ARB staff has developed a year 2020 "business-as-usual" (BAU) forecast of GHG emissions for use in developing the Draft Scoping Plan. Figure 2-3 shows CARB's inventory for the year 2020, which is AB 32's target inventory.

Figure 2-2
2004 GHG Emissions by Sector (Gross Emissions: 484.4 MMT CO2eq.)



Source: CARB, 2007

Figure 2-3
1990 GHG Emissions by Sector (Gross Emissions: 433.3 MMT CO2eq.)



Source: CARB, 2007

On December 6, 2007, the Air Resources Board (ARB) approved a regulation for the mandatory reporting of greenhouse gas emissions from major sources, pursuant to AB 32. The mandatory reporting regulation specifies the types of facilities that must report their GHG emissions, requirements for reporting and estimating the GHG emissions, and requirements for emissions verification. Upon adoption, the CARB Board directed staff to make other conforming modifications, as may be appropriate, based on comments received. Subsequent to adoption, the mandatory reporting regulation has undergone two sets of modifications.

Consistent with the requirement to develop a scoping plan indicating how GHG emission reductions will be achieved through regulations, market mechanisms, and other actions, the Draft Scoping Plan was released for public review and comment on June 26, 2008, followed by workshops in July and August, 2008.

The Draft Scoping Plan calls for achievable GHG emission reduction in California's carbon footprint to 1990 levels. Reducing greenhouse gas emissions to 1990 levels means cutting approximately 30 percent from BAU emission levels projected for 2020, or about 10 percent from today's levels. Key elements of CARB's preliminary recommendation for reducing California's greenhouse gas emissions to 1990 levels by 2020 contained in the Draft Scoping Plan include the following:

- Expansion and strengthening of existing energy efficiency programs and building and appliance standards;
- Expansion of the Renewables Portfolio Standard for electricity generation to 33 percent;
- Development of a California cap-and-trade program that links with other WCI Partner programs to create a regional market system;
- Implementation of existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard; and
- Targeted fees to fund the State's long-term commitment to AB 32 administration.

The Scoping Plan is expected go to the CARB Board for adoption in November, 2008.

INITIAL GUIDANCE ON EVALUATING GHGS PURSUANT TO CEQA

As noted in Chapter 1, both the California Attorney General's Office and the OPR determined that GHG emissions contributing to global climate change have the potential to generate adverse environmental impacts that should be evaluated pursuant to CEQA. Until recently, however, there has been little or no guidance relative to analyzing GHG emissions in CEQA documents or determining significance. The first explicit guidance was provided by the Association of Environmental Professionals (AEP) in its White Paper on Global Climate Change (AEP, 2007) and the White Paper on CEQA and Climate Change prepared by the California Air Pollution Control Officers Association (CAPCOA, 2008). The content of each of these White Papers is summarized in the following subsections.

- Association of Environmental Professionals – White Paper on Global Climate Change

AEP's White Paper (AEP) was one of the first attempts to discuss GHGs in the context of CEQA. The intent of the White Paper was to provide practical, interim information to CEQA practitioners and to help Lead Agencies determine how to address GHGs and global climate change in CEQA documents prior to the development and adoption of guidance by appropriate government agencies. Further, AEP's White Paper provided a summary of the current regulatory environment surrounding GHG emissions, and the various approaches that a Lead Agency may select in a CEQA document to address the potential impacts of global climate change and a project's cumulative contribution to GHG. The White Paper described several approaches for addressing GHGs and global Climate Change in CEQA documents, but did not recommend a single approach or methodology, leaving that decision to local Lead Agencies. The AEP White Paper identified eight approaches for analyzing GHGs and global climate change, which are summarized in the following bullet points.

- **Approach 1 – No Analysis:** under this approach the Lead Agency would not mention or discuss GHGs or global climate change.
- **Approach 2 – Screening Analysis:** under this approach the Lead Agency would establish a process to screen projects and determine that they would not make significant contributions to GHG emissions or GCC and, therefore, would not need to mitigate accordingly.
- **Approach 3 – Qualitative Analysis without Significance Determination:** this approach involves a qualitative discussion of GHGs and global climate change and potential ways the project will contribute to the generation of GHG emissions, but does not provide any significance conclusions.
- **Approach 4 – Qualitative Analysis with Significance Determination:** under this approach the Lead Agency would qualitatively discuss GHGs and climate change impacts and conclude that the project impacts are significant.
- **Approach 5 – Quantitative Analysis without Significance Determination:** under this approach the Lead Agency would quantify GHG emissions from the proposed project, but the results are not compared to a quantitative significance threshold.
- **Approach 6 – Quantitative Analysis with Net Zero Threshold:** this approach involves quantifying GHG emissions and using zero net carbon dioxide equivalent increase as the threshold.
- **Approach 7 – Quantitative Analysis Relative to California GHG Emission Reduction Strategies:** this approach employs both quantitative and qualitative components. The quantitative analysis contains an inventory of project GHG emissions. The qualitative component involves project compliance with the emission reduction strategies contained in the California Climate Action Team's (CAT) Report to the Governor, which contains recommendations and strategies to help ensure the targets in Executive Order S-3-05 are met.
- **Approach 8 – Use of Partial Exemption, "Within the Scope" of a Program EIR, or Tiering:** this option relies on the preparation of a broad EIR on a plan, program, or zoning action that is certified and contains a cumulative GHG and global climate change

impact analysis and mitigation. A later project that is consistent with the actions, goals, and/or policies in that plan, program, or zoning action need not again evaluate the cumulative impact regarding the project's GHG contribution to global climate change. In this situation, the later project may use the "partial exemption" provision of Public Resources Code §21083.3 and CEQA Guidelines §15183.

Since the date that the AEP White Paper was finalized (June, 2007), it has become clear that any of the above eight options that do not include quantification of GHG emissions and a determination of significance would be vulnerable to legal challenge. In addition, with the exception of the net zero approach in option 6, none of the options evaluated identify potential GHG significance thresholds. Approaches to developing GHG significance thresholds were specifically addressed in CAPCOA's White Paper (CAPCOA, 2008).

- California Air Pollution Control Officers Association – White Paper: CEQA and Climate Change

The intent of CAPCOA's White Paper is to serve as a resource for public agencies as they establish procedures for reviewing GHG emissions from projects under CEQA. It considers the application of thresholds and offers three alternative programmatic approaches toward determining whether GHG emissions are significant. Although the White Paper considers an option of not establishing a GHG significance threshold, as already noted this option is not considered to be a viable approach and will not be considered further. Ultimately, the White Paper is intended to provide consistent approaches for public agencies to ensure that GHG emissions are appropriately considered and addressed under CEQA.

The CAPCOA White Paper identifies three programmatic approaches to establishing GHG significance thresholds and also discusses the benefits and problems associated with each approach. Each approach has inherent advantages and disadvantages. The three basic approaches are:

- No significance threshold for GHG emissions (not discussed further);
- GHG emissions threshold set at zero; or
- GHG threshold set at a non-zero level, two approaches.

The following subsections briefly summarize two of the three major programmatic approaches developed by CAPCOA.

- Zero Threshold

An air district or lead agency may determine that any degree of project-related increase in GHG emissions would contribute considerably to climate change which, therefore, would be considered a significant impact. As a result, the air district or lead agency could adopt a zero-emission GHG threshold. If the zero threshold option is chosen, the lead agency would be required to quantify and mitigate GHG emissions for all projects subject to CEQA, regardless of the size of the project or the availability of GHG reduction measures available to reduce the project's emissions. Projects that could not meet the zero-emission threshold would be required to undergo an environmental impact report (EIR) CEQA process to disclose the unmitigable significant impact, and develop the justification for a statement of overriding consideration to be adopted by the lead agency.

CAPCOA notes in the White Paper that if an air district or lead agency elects to adopt a zero threshold approach, it should consider the administrative costs and the environmental review system capacity. Some projects that previously would have qualified for an exemption could require further substantial analysis, including preparation of a Negative Declaration (ND), a Mitigated Negative Declaration (MND) or an EIR. Moreover, the trade-offs between the volume of projects requiring review and the quality of consideration given to reviews should be considered. It may also be useful to consider whether meaningful mitigation can be achieved from smaller projects.

- *Approach 1: Non-Zero Threshold – Statute and Executive Order Approach*

According to CAPCOA, a non-zero GHG significance threshold could minimize the resources spent reviewing environmental analyses that do not result in real GHG reductions or to prevent the environmental review system from being overwhelmed. The practical advantages of considering non-zero thresholds for GHG significance determinations can fit into the concept regarding whether the project's GHG emissions represent a "considerable contribution to the cumulative impact" and therefore warrant analysis.

The first non-zero GHG significance threshold approach is based on achieving the objectives of AB 32 or executive order EO S-3-05 and explores four possible options under this scenario. A project would be required to meet the target objectives, or reduce GHG emissions to the target objectives, to be considered less than significant. The options under this approach are variations of ways to achieve the 2020 goals of AB 32 from new development, which is estimated to be about a 30 percent reduction from business-as-usual. Table 2-1 summarizes the four statute and executive order approaches identified by CAPCOA. SCAQMD staff has identified and included in Table 2-1 potential pros and cons identified for each option.

- *Approach 2: Non-Zero Threshold – Tiered Threshold Options*

The second non-zero GHG significance threshold approach is comprised of a number of tiered GHG significance threshold options. Within this option, the CAPCOA White Paper discusses seven variations. The tiered threshold options offer both quantitative and qualitative approaches to setting a threshold, as well as different metrics for establishing the various tiers. Variations range from setting the first tier at zero to second tiers set at defined emission levels or based on the size of a project. This approach would then prescribe a set of GHG mitigation strategies that would have to be incorporated into the project in order for the project to be considered less than significant. CAPCOA notes that some applications of the tiered threshold approach may require inclusion in a General Plan or adoption of enabling regulations or ordinances to render them fully effective and enforceable. The various tiered threshold options are summarized in Table 2-2. SCAQMD staff has identified and included in Table 2-2 potential pros and cons identified for each option.

Table 2 – 1
Statute and Executive Order Approach

Threshold Number	Description of Threshold	Pros*	Cons*
1.1	Project must reduce emissions compared to business as usual to be less than significant, two approaches: a. Project must reduce GHG emissions 33 percent compared to business-as-usual (BAU) (2020 target), or b. Project must reduce GHG emissions 80 percent compared to business-as-usual (2050 target).	• Could reduce resource impacts compared to zero threshold, as not every project would require an EIR • Would achieve GHG reductions consistent with AB 32 • A single threshold is easier to apply and understand	• Could be viewed as setting a de minimis level • Fewer projects would trigger significance, thus, less mitigation • BAU should be defined by CARB • BAU may be difficult to define for all projects
1.2	All new projects must reduce GHG emissions compared to BAU by a uniform percentage to be considered less than significant, e.g., 50 percent.	• Same as 1.1 • May produce greater percent reduction of GHGs • Single threshold easier to apply & understand	• Could produce substantially greater GHG reductions than 1.1, but may be difficult to achieve • BAU should be defined by CARB • BAU may be difficult to define for all projects

* Pros and cons reflect only SCAQMD staff's evaluation of the approaches.

Table 2 – 1 (Concluded)
Statute and Executive Order Approach

Threshold Number	Description of Threshold	Pros*	Cons*
1.3	Projects must reduce GHG emissions compared to business-as-usual by a uniform percentage based on economic sector to be less than significant, i.e., different reductions required for different market sectors.	• Sector-specific approach may be more appropriate approach • Would take into account costs & available control technologies • Avoids over- or under-regulation of GHGs per sector	• Requires extensive information on emission inventories • Requires extensive information on control technologies • Difficult to determine percent reduction by sector • Because of information requirements, may be more viable in the long term
1.4	Uniform GHG emission reduction by region. Regional GHG reduction plan developed consistent with AB32 emission reductions, e.g., reduce GHG emissions 33% or 80% compared to BAU. A project is not significant if its GHG emissions are consistent with plan.	• Could tailor GHG reductions to specific regional needs • GHG reduction strategies could be integrated into regional plans	• Would need to establish GHG regions • Requires extensive information on regional emission inventories • Because of the need to develop a regional plan, may be a more viable interim approach

* Pros and cons reflect only SCAQMD staff's evaluation of the approaches.

Table 2 – 2
Tiered Threshold Options

Threshold Number	Description of Threshold	Pros*	Cons*
2.1	This threshold employs a decision tree approach. Tier 1, no increase in GHG emissions, not significant (zero threshold). If GHG emissions greater than zero, tier two, use one of the following threshold options.	• Tiered approach allows flexibility by establishing multiple thresholds to cover a wide range of projects • Tier 2 may minimize administrative burden & costs • Tiers could be set at different levels depending on GHGs, size & other project characteristics • Projects exceeding tier 2 must implement mitigation	• Tier 1 may increase administrative burdens & costs • There may not be meaningful mitigation for small projects • Available mitigation may consist of purchasing offsets • EJ concerns of purchasing offsets because of associated criteria pollutant emissions • Offset markets not well established
2.2	Establish a quantitative threshold based on capturing a percentage, e.g., 90%, of future discretionary projects, CAPCOA's threshold is 900 metric tons CO2eq per year (equivalent to 50 houses or 30,000 square feet of commercial space, i.e., CAPCOA assumes 90% of all projects are this size or greater). Projects less than this would not be significant.	• Would capture a larger percentage of projects in the district than is currently the case • Would exclude small projects from further GHG analysis • Single threshold easier to apply & understand	• Would increase administrative & cost burden, especially in developing & moderate growth areas • May not be amenable to industrial projects because of the diversity of these projects • There may not be meaningful mitigation for small projects

* Pros and cons reflect only SCAQMD staff's evaluation of the approaches.

Table 2 – 2 (Continued)
Tiered Threshold Options

Threshold Number	Description of Threshold	Pros*	Cons*
2.3	This threshold is based on CARB's proposed mandatory reporting threshold of 25,000 metric tons of CO2eq per year. Alternatively, use the Market Advisory Committee of 10,000 metric tons of CO2eq per year. Projects less than either would not be significant.	• CARB estimates this threshold would capture 90 % of all industrial projects • Single threshold easier to apply & understand	• May not be amenable to industrial projects because of the diversity of these projects • There may not be meaningful mitigation for small projects
2.4	This approach establishes a GHG threshold based on and analogous to a NOx/VOC criteria pollutant CEQA significance threshold and is established using the following four steps: a. Define NOx/VOC CEQA thresholds in tons per year (e.g., 10 t/yr) b. Define the regional NOx/VOC inventory in tons per year (e.g., annual NOx inventory for 2005 from 2007AQMP ~ 375,585 t/yr) c. Calculate percentage of NOx/VOC inventory the significance threshold represents (10 / 375,585 = 0.00003) to obtain "minimum percentage of regulated inventory" for NOx/VOC.	• Single threshold easier to apply & understand	• Threshold cumbersome to derive • Threshold would change periodically as inventory goes up or down • Could have widely divergent thresholds by air basin because of varying inventories

* Pros and cons reflect only SCAQMD staff's evaluation of the approaches.

Table 2 – 2 (Continued)
Tiered Threshold Options

Threshold Number	Description of Threshold	Pros*	Cons*
2.4 (Cont.)	d. Define California GHG emission inventory for 2004 in tons CO2eq per year (499 MMT CO2eq). Apply minimum percentage of regulated inventory to California GHG inventory for 2004 to develop a GHG threshold analogous to the CEQA Threshold (e.g., 0.00003 x 499 MMT = 14,970 metric tons CO2eq per year = significance threshold).	•	•
2.5	Establish quantitative unit-based thresholds based on capturing a percentage, e.g., 90%, of future discretionary projects in specific market sectors (similar to 2.2 above). CAPCOA examples include: • 30,000 square-foot (SF) office =800 metric tons CO2eq per year; • 30,000 SF retail = 2,500 metric tons CO2eq per year; • 30,000 SF supermarket = 43,000 metric tons CO2eq per year.	• Would capture a larger percentage of projects in the district than is currently the case • Would exclude small projects from further GHG analysis • Single threshold easier to apply & understand	• Would increase administrative & cost burden, especially in developing & moderate growth areas • May not be amenable to industrial projects because of the diversity of these projects • There may not be meaningful mitigation for small projects

* Pros and cons reflect only SCAQMD staff's evaluation of the approaches.

Table 2 – 2 (Concluded)
Tiered Threshold Options

Threshold Number	Description of Threshold	Pros*	Cons*
2.6	This threshold would include tiered CEQA thresholds based on CEQA's definition of "projects with statewide, regional or areawide significance (§15206(b)), which include: • Residential development > 500 dwellings • Shopping center or business establishment employing > 1,000 persons or > 500,000 SF • Commercial office building employing >1,000 persons or > 250,000 SF • Hotel/motel > 500 rooms • Industrial, manufacturing or processing plant or industrial park employing > 1,000 persons or > 600,000 SF	• Could capture up to 50% of all future commercial development	• May capture substantially less than 50% if future development, resulting less GHG mitigation • Percentage capture of industrial/manufacturing projects currently unknown
2.7	Efficiency-based thresholds would be based on measurements of efficiency compared to intensity. Must be based on reasonable GHG emissions compared to business-as-usual.	• Would benchmark GHG intensity against target levels of efficiency • Thresholds established to provide future foreseeable GHG reductions compared to BAU • Would support AB 32 target objectives	• Would require substantial data & possibly modeling • May be more appropriate as a threshold in the long term

* Pros and cons reflect only SCAQMD staff's evaluation of the approaches.

CHAPTER 3

INTERIM GHG SIGNIFICANCE THRESHOLD STAFF PROPOSAL

Introduction

GHG Analysis Considerations

Current Staff Interim GHG Significance Threshold Proposals

INTRODUCTION

Because GHG emissions affect global climate, some have argued that it may be more appropriate for national or state agencies to establish significance thresholds or GHG emission reduction target objectives. However, no agency has established GHG significance thresholds that could assist Lead Agencies with determining the significance of GHG emissions in CEQA documents. In the absence of statewide guidance on this issue and in response to requests from a variety of stakeholders, the SCAQMD established a GHG Significance Threshold Stakeholder Working Group (Working Group) to establish an interim GHG significance threshold until such time as the state establishes a GHG significance threshold or provides recommended guidance on establishing a GHG significance threshold. Staff's goal is to reach consensus regarding an interim GHG significance threshold to the extent possible and take the staff proposal to the SCAQMD Governing for consideration and approval.

The Working Group was formed to assist staff's efforts to develop an interim GHG significance threshold an is comprised of a wide variety of stakeholders including: state agencies, OPR, CARB, and the Attorney General's Office; local agencies, city and county planning departments, utilities such as sanitation and power, etc.; regulated stakeholders, industry and industry groups; and organizations, both environmental and professional. Stakeholders were chosen based on their participation in other related stakeholder working groups and their expressed interest in participating in the developing a GHG significance threshold. Working group meetings are open to the public and have been well attended. The members of the Working Group and other interested parties who have requested to be notified of the meetings are listed in Appendix A. Information on the progress of the Working Group, including agendas, overhead presentations, and letters received from the various stakeholders can be found at the following website:
https://www.aqmd.gov/ceqa/handbook/GHG/GHG.html.

Part of the purpose of the Working Group is to provide a forum to solicit comments and suggestions from the various stakeholders to assist SCAQMD staff with developing an interim GHG significance threshold that is consistent with CEQA requirements for developing significance thresholds, is supported by substantial evidence, and provides guidance to CEQA practitioners with regard to determining whether GHG emissions from a proposed project are significant.

SCAQMD staff held the first Working Group meeting in April 2008. Except for September, Working Group meetings have been held on a monthly basis since April. Brief summaries of each Working Group meeting and the topics and staff GHG significance threshold proposals discussed to date are provided in Appendix B. Staff's initial proposed has been modified over time based on comments and concerns raised at Working Group meetings or in written comments. The following sections summarize staff's latest recommended interim GHG significance threshold proposal and some of the concepts necessary to understanding the various components of staff's

proposal. The latest staff proposal is considered to be a work-in-progress as staff is continuing to solicit further public input and suggestions.

The following subsections briefly summarize the GHG significance threshold design criteria concepts included as part of staff's proposed interim GHG significance threshold proposal. Following the discussion of design concepts, SCAQMD staff's current interim proposal is described.

GHG ANALYSIS CONSIDERATIONS

Before discussing quantification methodologies, it is necessary to consider design criteria that establish the parameters upon which the actual GHG analysis is based. The following subsections include discussions from the Working Group of some of the most important design criteria to be considered when quantifying GHG emissions. The following topics include some of the most important parameters that should be considered when quantifying GHG emissions and, therefore, should not be considered an exhaustive list of considerations as individual projects may include characteristics that may require additional considerations.

Policy Objective

The overarching policy objective with regard to establishing a GHG significance threshold for the purposes of analyzing GHG impacts pursuant to CEQA is to establish a performance standard or target GHG reduction objective that will ultimate contribute to reducing GHG emissions to stabilize climate change. Full implementation of the Governor's Executive Order S-3-05 would reduce GHG emissions 80 percent below 1990 levels or 90 percent below current levels by 2050. It is anticipated that achieving the Executive Order's objective would contribute to worldwide efforts to cap GHG concentrations at 450 ppm, thus, stabilizing global climate.

As described below, staff's recommended interim GHG significance threshold proposal uses a tiered approach to determining significance. Tier 3, which is expected to be the primary tier by which the AQMD will determine significance for projects where it is the lead agency, uses the Executive Order S-3-05 goal as the basis for deriving the screening level. Specifically, the Tier 3 screening level for stationary sources is base on an emission capture rate of 90 percent for all new or modified projects. A 90 percent emission capture rate means that 90 percent of total emissions from all new or modified stationary source projects would be subject to some type of CEQA analysis, including a negative declaration, a mitigated negative declaration, or an environmental impact.

Therefore, the policy objective of staff's recommended interim GHG significance threshold proposal is to achieve an emission capture rate of 90 percent of all new or modified stationary source projects. A GHG significance threshold based on a 90 percent emission capture rate may be more appropriate to address the long-term adverse impacts associated with global climate change. Further, a 90 percent emission

capture rate sets the emission threshold low enough to capture a substantial fraction of future stationary source projects that will be constructed to accommodate future statewide population and economic growth, while setting the emission threshold high enough to exclude small projects that will in aggregate contribute a relatively small fraction of the cumulative statewide GHG emissions. This assertion is based on the fact that staff estimates that these GHG emissions would account for less than one percent of future 2050 statewide GHG emissions target (85 MMTCO2eq/yr). In addition, these small projects would be subject to future applicable GHG control regulations that would further reduce their overall future contribution to the statewide GHG inventory

- GHG Pollutants

Gases that trap heat in the atmosphere are often called greenhouse gases. The Kyoto Protocol, adopted in December 1997, is an agreement under which industrialized countries will reduce their collective emissions of greenhouse gases by specified percentages, depending on the country, compared to 1990 levels. The goal is to lower overall emissions of six greenhouse gases - carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, hydrofluorocarbons, and perfluorocarbons, averaged over the period of 2008-2012.

Similarly, AB 32 defines GHGs as including the following: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (Health and Safety Code, section 38505(g)). The most common GHG that results from human activity is carbon dioxide, followed by methane and nitrous oxide.

Some greenhouse gases such as carbon dioxide occur naturally and are emitted to the atmosphere through natural processes and human activities. Other greenhouse gases (e.g., fluorinated gases) are created and emitted solely through human activities. The principal greenhouse gases that enter the atmosphere because of human activities are:

- **Carbon Dioxide (CO2):** Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). Carbon dioxide is also removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.

- **Methane (CH4):** Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

- **Nitrous Oxide (N2O):** Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

- **Fluorinated Gases:** Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting substances (i.e., CFCs, HCFCs, and halons). Fluorinated gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as high global warming potential gases (high GWP gases).

    - Hydrofluorocarbons are manmade chemicals that have historically replaced Chlorofluorocarbons used in refrigeration and semiconductor manufacturing.

    - Perfluorocarbons are manmade chemicals that are by-products of aluminum smelting and uranium enrichment.

    - Sulfur hexafluoride is a manmade chemical that is largely used in heavy industry to insulate high voltage equipment and to assist in the manufacturing of cable cooling systems.

GWP is a measure of how much a given mass of greenhouse gas is estimated to contribute to global warming. It is a relative scale that compares the gas in question to the same mass of carbon dioxide (whose GWP is by definition 1). A GWP is calculated over a specific time interval and the value of this must be stated whenever a GWP is quoted or else the value is meaningless. A substance's GWP depends on the time span over which the potential is calculated. A gas which is quickly removed from the atmosphere may initially have a large effect but for longer time periods as it has been removed becomes less important. For the purposes of a CEQA analysis, especially an analysis of operation emissions, the maximum GWP is typically used, regardless of the actual atmospheric lifetime. This approach simplifies the analysis and provides a very conservative analysis, especially for the fluorinated gases. The GWP of the six Kyoto GHGs is shown in Table 3-1.

The SCAQMD staff recommends that a GHG analysis include the six Kyoto GHGs, to the extent emission factors are available primarily because there is more information on these GHGs than other potential GHGs. Other GHGs would be added to the list as scientific information becomes available and agreed to by national or international protocols and agreements.

Table 3-1
Global Warming Potential of Kyoto GHGs

Gas	Atmospheric Lifetime	GWP
Carbon dioxide (CO2)	50 – 200	1
Methane (CH4)	12 $\pm$ 3	21
Nitrous oxide (N2O)	120	310
HFC-23 (Hydrofluorocarbons)	264	11,700
HFC-32	5.6	650

Table 3-1 (Concluded)
Global Warming Potential of Kyoto GHGs

Gas	Atmospheric Lifetime	GWP
HFC-125	32.6	2,800
HFC-134a	14.6	1,300
HFC-143a	48.3	3,800
HFC-152a	1.5	140
HFC-227ea	36.5	2,900
HFC-236fa	209	6,300
HFC-4310mee	17.1	1,300
CF4 (Perfluorocarbons)	50,000	6,500
C2F6	10,000	9,200
C4F10	2,600	7,000
C6F14	3,200	7,400
Sulfer hexafluoride (SF6)	3,200	23,900

Source: U.S. EPA (http://www.epa.gov/)

Carbon black, a form of particulate air pollution most often produced from biomass burning, cooking with solid fuels and diesel exhaust, may also have a warming effect in the atmosphere. It is estimated that carbon black's contribution to climate change is second only to carbon dioxide. Carbon black contributes to global warming by absorbing heat while airborne in the atmosphere. Carbon black is of particular concern in the arctic because it settles on ice and snow, reducing its reflectivity and increasing the rate of melting.

Based on a survey of available information, there are little data available for calculating carbon black effects on global warming. As a result, SCAQMD staff is not recommending analyzing carbon black effects on global warming. As information becomes available, staff will reconsider adding carbon black to the list of GHGs to be analyzed in CEQA documents.

Business-As-Usual (BAU)

In CARB's Scoping Plan (CARB, 2008) CARB states that the BAU case is a representation of what the state of the California economy will be in the year 2020 assuming that none of the measures recommended in the Scoping Plan are implemented. CARB's projected BAU GHG emissions in 2020 are shown in Table 3-2.

Table 3-2
2002-2004 Average Emissions and 2020 Projected Emissions (Business-as-Usual)
(MMTCO2E)

Sector	2002-2004 Average Emissions	Projected 2020 Emissions [BAU]
Transportation	179.3	225.4
Electricity	109.0	139.2
Commercial and Residential	41.0	46.7
Industry	95.9	100.5
Recycling and Waste	5.6	7.7
High GWP	14.8	46.9
Agriculture	27.7	29.8
Forest Net Emissions -	4.7	0.0
Emissions Total	**469**	**596**

Source: CARB, 2008 – Scoping Plan, Table 1

CARB's Scoping Plan states further that continuing increases in global greenhouse gas emissions at BAU rates would result, by late in the century, in California losing 90 percent of the Sierra snow pack, sea level rising by more than 20 inches, and a three to four times increase in heat wave days, flood damage, etc. To avoid future foreseeable environmental impacts to California, the Scoping plan calls for an ambitious but achievable reduction in California's carbon footprint. Reducing greenhouse gas emissions to 1990 levels means reducing approximately 30 percent from BAU emission levels projected for 2020, or about 15 percent from today's levels. On a per-capita basis, that means reducing our annual emissions of 14 tons of carbon dioxide equivalent for every man, woman and child in California down to about 10 tons per person by 2020.

Although CARB's Scoping Plan calls for reducing GHG emissions 30 percent from BAU levels, it does not explicitly define BAU. There is, however, a brief definition of BAU in CARB's GHG inventory document (CARB, 2007). In that document CARB describes BAU as:

- BAU is based on GHG emissions estimates in the absence of policies and reduction measures, and
- BAU is based on forecasted demographic and economic growth.

In its White Paper, CAPCOA provides a more detailed definition of BAU compared to the above definition in CARB's inventory document. In the White Paper BAU is defined as follows:

- The projection of GHGs into the future based on current technologies and regulations;

- The adoption of new GHG reduction regulations, e.g., CARB's Scoping Plan measures, in the future establishes new BAU, i.e., the definition of BAU evolves over time; and
- BAU will normally define the CEQA no project alternative, but does not necessarily form the project baseline.

Based on the above definitions and discussions from the Working Group, SCAQMD staff defines BAU as the following

- Is used to project project's future emissions (consistent with CAPCOA and CARB definitions), i.e., level from which GHG reductions must occur;
- Is based first and foremost on current regulatory requirements (consistent with CAPCOA and CARB definitions);
- Regulatory requirements may determine current technology, e.g., advanced technology may be available, but not required, such as combined cycle gas turbine;
- Will normally define the no project alternative (consistent with CAPCOA and CARB definitions); and
- May be used to establish a project's CEQA baseline, only if consistent with CEQA Guidelines §15125.

The importance of BAU lies not only in the fact that it is a methodology for calculating a project's future emissions, is also forms the emission level from which GHG emission reductions must occur. SCAQMD staff's current GHG significance threshold proposal includes the Tier 4 compliance option 1 that establishes a performance standard of reducing GHG emissions 30 percent below the project's projected BAU emissions through design features and/or mitigation measures. A 30 percent reduction from BAU is consistent with the target objectives of AB 32 and CARB's Scoping Plan. The intent of the Tier 4 compliance option 1 is to provide a feasible target objective, that will not only contribute to achieving the AB 32 target objective, but will also contribute to achieving the 2050 target of the Governor's Executive Order S-3-05, which establishes of target objective of reducing GHG emissions 80 percent below 1990 levels or a 90 percent reduction from current BAU estimates.

As recognized by CAPCOA and SCAQMD, BAU will evolve over time as the current regulatory framework changes to implement GHG reduction strategies, either statewide strategies, e.g., CARB's Scoping Plan, or any future federal strategies. Evolving BAU creates two issues for the CEQA practitioner. First, staff's proposed Tier 4 compliance option 1 target objective is unchanged from 30 percent, then over time as BAU changes to incorporate GHG reduction strategies, achieving the target objective will become more difficult. Second, any GHG significance thresholds that rely on BAU will have higher uncertainties because they rely on a constantly changing BAU, which may be difficult to define.

To resolve some of these issues of an evolving definition of BAU, SCAQMD staff recommends that a statewide definition be developed by CARB that is updated periodically. Until such time as a statewide definition of BAU is developed, the SCAQMD staff will rely on the above definition. Because the SCAQMD's staff's GHG significance proposal is considered to be an interim proposal, future updates or revisions to staff's proposal would also include updates to BAU or the target objective as BAU levels decline over time. It may be that a target objective percent reduction from BAU levels is a short-term GHG threshold proposal and may become less important in the future as other concepts are evaluated and more fully developed.

- GHG Source Categories to Analyze

Life Cycle Analysis

CEQA requires that the lead agency analyze direct and indirect impacts from a proposed project, giving due consideration to short-term and long-term effects (CEQA Guidelines 15126.2(a)). In the case of GHG pollutants a systems approach to evaluating the consequences of a particular product, process or activity may be more appropriate because of the long atmospheric lifetimes of the various GHGs (see Table 3-1). One of the most effective ways of evaluating GHGs using a systems approach is through the preparation of a life cycle analysis (LCA).

The goal of a life cycle analysis is to compare the full range of environmental damages assignable to products and services, to be able to choose the least burdensome one. The term 'life cycle' refers to the concept that a fair, holistic assessment requires the assessment of raw material production, manufacture, distribution, use and disposal including all intervening transportation steps necessary or caused by the product's existence. The sum of all those steps - or phases - is the life cycle of the product.

Performing a life cycle analysis may be difficult for a number of projects or processes because life cycle emission factors may not be well established for many activities or projects and the life cycle process itself may not be known or well-defined. SCAQMD staff, however, recommends that life cycle analyses be prepared for all projects undergoing a CEQA analysis, as this will produce a more defensible approach. If, however, any component of the life cycle analysis is unavailable, unknown, or not supported by scientific evidence, the lead agency should note such an analysis would be speculative pursuant to CEQA Guidelines §15145 and terminate discussion of that impact.

Direct/Indirect Impacts

Consistent with CEQA, indirect and direct impacts of the project, typically within California, are required to be analyzed in the CEQA document for a proposed project. The analysis of direct GHG impacts is relatively straightforward as onsite GHG sources or directly related offsite GHG sources, such as worker commute trips, are generally readily identifiable. Indirect GHG emission sources are less obvious, but may include some of the sources identified in the following paragraphs. In general,

for most projects information on direct and indirect emissions may be available, rather than a full life-cycle analysis of emissions. The lead agency has typically been expected to address emissions that are closely related and within the capacity of the project proponent to control and/or influence.

Direct Impacts - are primary effects that are caused by a project and occur at the same time and place, such as emissions from boilers, heaters, or other onsite emissions sources. Direct impacts generated by a project may include offsite sources directly related to the project such as emissions from worker commute trips, haul truck trips to import raw materials and/or export finished products or other goods.

Direct GHG emission impacts will include both construction and operation activities. Because impacts from construction activities occur over a relatively short-term period of time, they contribute a relatively small portion of the overall lifetime project GHG emissions. In addition, GHG emission reduction measures for construction equipment are relatively limited. Therefore, SCAQMD staff is recommending that construction emissions be amortized over a 30-year project lifetime, so that GHG reduction measures will address construction GHG emissions as part of the operational GHG reduction strategies.

Indirect Impacts - The CEQA Guidelines define indirect impacts as the following: an indirect physical change in the environment…which is not immediately related to the project, but which is caused indirectly by the project. If a direct physical change in the environment in turn causes another change in the environment, then the other change is an indirect change in the environment (CEQA Guidelines §15064 (d)(2)). Indirect or secondary effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems (CEQA Guidelines §15358)(a)(2)).

DRAFT STAFF INTERIM GHG SIGNIFICANCE THRESHOLD PROPOSAL

As indicated by the evolution of the staff proposal over time, SCAQMD has generally recommended a tiered decision tree approach to establishing a GHG significance threshold. In CAPCOA's White Paper, eight of the 12 significance threshold options are based on a tiered threshold approach (see also Table 2-2 in Chapter 2). A tiered GHG significance threshold approach is an appealing approach because it provides flexibility in determining whether or not GHG emissions from a project are significant typically using a single methodology to establish various tiers that can be based on the physical size of the project, land use type, or other characteristics. The tiered approach envisioned by SCAQMD staff would require quantification of GHG emissions for all projects that are subject to CEQA and quantification of the GHG reduction effectiveness of design parameters incorporated into the project and any mitigation measures imposed by the lead agency. It may even be necessary to

quantify GHG emissions, if any, for projects that would otherwise qualify for a categorical exemption to document that no "cumulative impact of successive projects of the same type in the same place, over time is significant" (CEQA Guidelines §15300.2(b), or that there is no "reasonable possibility that the activity will have a significant effect on the environment due to unusual circumstances." (CEQA Guidelines §15300.2(c)).

The CAPCOA White Paper also includes a discussion of a decision tree approach to tiering. Instead of using a single methodology to establish tiers, a decision tree approach would use multiple methodologies to demonstrate significance for a broad range of projects/plans that may be difficult to address using a single GHG significance threshold methodology. Using a decision tree approach promotes even greater flexibility in determining significance for a variety of project types.

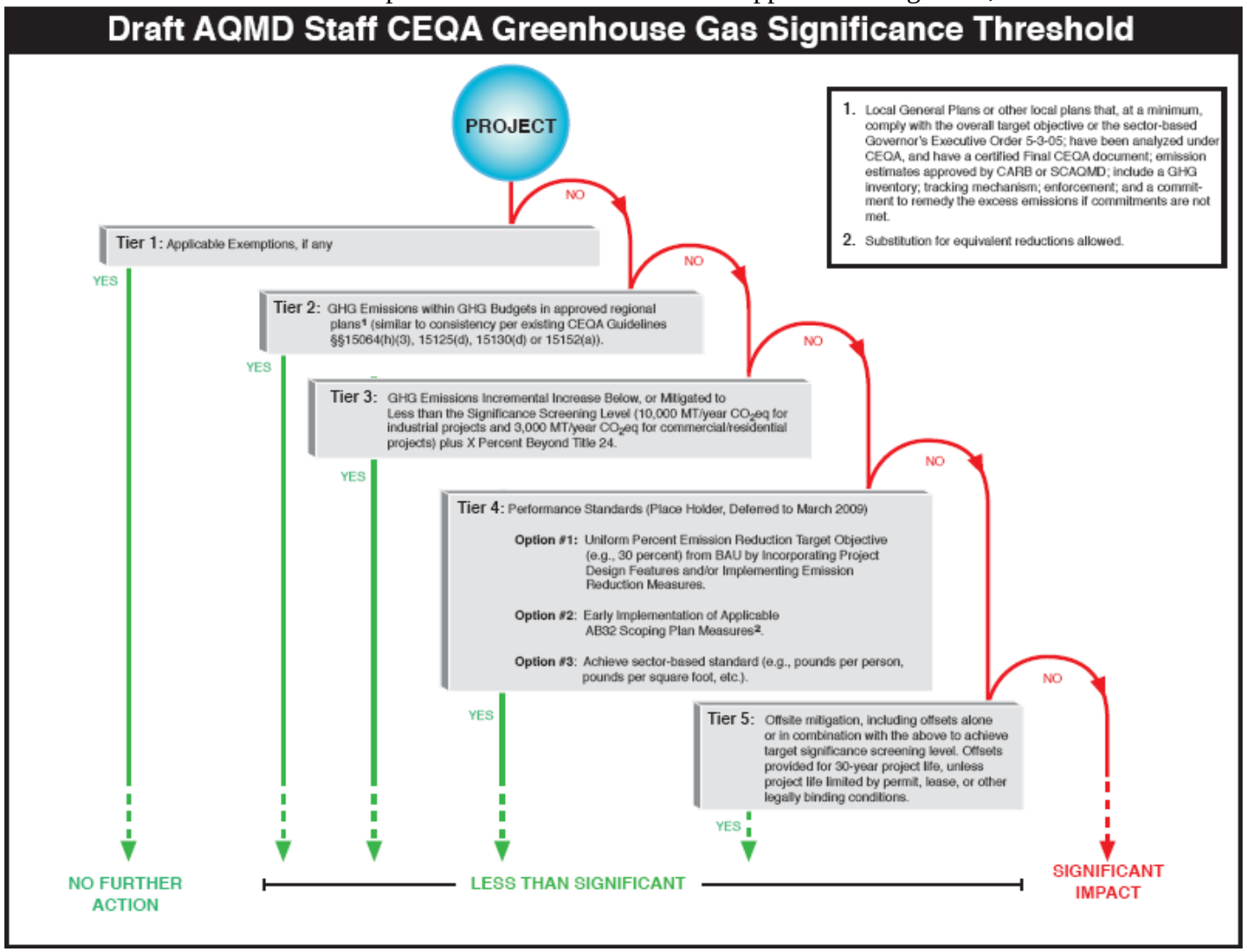
At the August 27, 2008 Working Group meeting #5, staff presented the revised interim GHG significance proposal #3, which included a tiered decision tree approach. Unlike the decision tree approach discussed in CAPCOA's White Paper, some tiers include multiple approaches for determining whether a project's GHG emissions are significant, rather than using a single different methodology for each tier.

For the purposes of determining whether or not GHG emissions from affected projects are significant, project emissions will include direct, indirect, and, to the extent information is available, life cycle emissions during construction and operation. Construction emissions will be amortized over the life of the project, defined as 30 years, added to the operational emissions, and compared to the applicable interim GHG significance threshold tier. The following bullet points describe the basic structure of staff's tiered GHG significance threshold proposal for stationary sources. The components of revised staff proposal #3 are described in the following paragraphs and shown graphically in Figure 3-1.

- **Tier 1 –** consists of evaluating whether or not the project qualifies for any applicable exemption under CEQA. For example, SB 97 specifically exempts a limited number of projects until it expires in 2010. If the project qualifies for an exemption, no further action is required. If the project does not qualify for an exemption, then it would move to the next tier.

- **Tier 2 –** consists of determining whether or not the project is consistent with a GHG reduction plan that may be part of a local general plan, for example. The concept embodied in this tier is equivalent to the existing concept of consistency in CEQA Guidelines §§15064(h)(3), 15125(d), or 15152(a). The GHG reduction plan must, at a minimum, comply with AB 32 GHG reduction goals; include emissions estimates agreed upon by either CARB or the SCAQMD, have been analyzed under CEQA, and have a certified Final CEQA document. Further, the GHG reduction plan must include a GHG emissions inventory tracking mechanism; process to monitor progress in achieving GHG emission reduction targets, and a commitment to remedy the excess emissions if AB 32 goals are not met (enforcement).

Figure 3-1
Revised Staff Proposal #3 Tiered Decision Tree Approach – August 27, 2008



If the proposed project is consistent with the local GHG reduction plan, it is not significant for GHG emissions. If the project is not consistent with a local GHG reduction plan or there is no approved plan, the GHG reduction does not include all of the components described above, or there is no adopted GHG reduction plan, the project would move to tier 3.

- **Tier 3 –** attempts to identify small projects that would not likely contribute to significant cumulative GHG impacts. However, because of the magnitude of increasing global temperatures from current and future GHG emissions, staff is recommending that all projects must implement some measure or measures to contribute to reducing GHG emissions. Therefore, Tier 3 includes a requirement that ~~all~~ residential/commercial projects with GHG emissions less than the screening level must include efficiency components that ~~reduce a certain~~go X percent~~age~~ beyond the requirements of Title 24 (Part 6, California Code of Regulations), California's energy efficiency standards for residential and nonresidential buildings. Project proponents would also have to reduce by a specified percentage electricity demand from water use, primarily electricity used for water conveyance.

  ~~The most recently~~A past recommended screening level proposed by staff was 6,500 MTCO2eq./year. This screening level was derived using the SCAQMD's existing NOx operational threshold as a basis. The daily NOx operational significance threshold, 55 pounds per day was annualized, which results in 10 tons of NOx per year.

  Staff initially considered and then rejected a bifurcated screening level, that is one screening level for residential and commercial projects and a different screening level for industrial projects based on the URBEMIS modeling runs used to derive the 6,500 MTCO3eq/yr screening level because GHG emissions from industrial were of the same magnitude as the GHG emissions from residential and commercial projects. Staff has reconsidered the bifurcated screening level approach as there is a more scientific basis for deriving the different screening levels.

  SCAQMD staff is now recommending a bifurcated screening level approach to address two greatly differing project types: industrial projects as opposed to residential and commercial projects (which are largely indirect sources). The former category typically contains stationary source equipment whose emissions are largely permitted or regulated by the SCAQMD; whereas the latter category is mostly residential, commercial (may also include industrial) building structures that attract or generate mobile source emissions. In light of the GHG reductions needed to stabilize the climate while considering implementation resource requirements, the policy objective used to establish the screening thresholds is to capture projects that represent approximately 90 percent of GHG emissions from new sources. The following paragraphs describe the steps taken to derive the screening threshold values.

Industrial Projects: Since the majority of GHG emissions in the district are comprised of CO2 emissions from burning natural gas rather than other types of fossil fuel, staff compiled reported annual natural gas consumption for 1,297~~115~~ permitted facilities for 2006-2007 and rank-ordered the facilities to estimate the 90th percentile of the cumulative natural gas usage for all permitted facilities. Operators of these facilities are required to report their emissions and associated throughput under the SCAQMD's Annual Emission Reporting (AER) Program if any of their criteria pollutant emissions exceed four tons per year (100 tons per year for CO) or if the facility has any reportable air toxics emission. Figure 3-2 shows that approximately 10 percent of facilities evaluated comprise more than 90 percent of the total natural gas consumption, which corresponds to 10,000 metric tons per year (tpy) of CO2 emissions. This value represents a boiler with a rating of approximately 27 million British thermal units per hour (mmbtu/hour) of heat input, operating at ~~a~~n ~~25~~ 80 percent capacity factor. If the screening threshold of 10,000 MTCO2eq./yr is implemented, based on the permitting activities for 2006-2007 it will result in at least 31 additional MNDs or EIRs being prepared by the SCAQMD as the lead agency unless another tier option is selected to demonstrate no significant impacts for GHG emissions. It should be noted that this analysis did not include other possible GHG pollutants such as methane, N2O; a life-cycle analysis; mobile sources; or indirect electricity consumption. Therefore, under a 10,000 MTCO2eq./yr screening level more projects would be required to go through an MND or EIR environmental analysis than is currently the case. Furthermore, when the SCAQMD acts as a lead agency, the stationary source equipment employed as part of the proposed project typically must comply with BACT or other SCAQMD rules, regulations, programs that require reducing criteria pollutants or air toxics. Therefore, staff is proposing to replace the 6,500 MTCO2/yr screening level with the 10,000 MTCO2eq/yr as the screening level in tier III for industrial projects when the SCAQMD is the lead agency for the project.

Residential and Commercial Projects: To achieve the same 90 percent GHG emission capture rate for this segment of projects GHG emissions from residential and commercial sectors were compared to the GHG emissions from the industrial sector including the in-state power plants. The draft AB32 scoping plan indicates that based on statewide 2002-2004 average GHG emissions, the residential and commercial sectors account for approximately nine percent of the total statewide GHG inventory, while the industrial sector (including instate power plants) accounts for approximately 30 percent of the statewide GHG emission inventory. The inventory methodology for both sectors includes only on-site energy use, consistent with the staff approach taken in deriving the 10,000 tpy threshold. Assuming similar emission characteristics also exist for the residential and commercial sector (i.e., large residential or commercial projects, although fewer in numbers, contribute substantially more to the total emissions), it is estimated that at a threshold of approximately 3,000 MTCO2eq/yr emissions (10,000 x (9 percent / 30 percent)) would capture 90 percent of the GHG emissions from new residential or commercial projects. A series of sensitivity analyses was performed by the staff using URBEMIS to assess the likely project size for 3,000 MTCO2eq/yr emissions. Table 3-3 illustrates various projects by size and shape.

Figure 3-2

Total Number of AER Facilities and Their Accumulative Reported NG Usage
FY 06-07

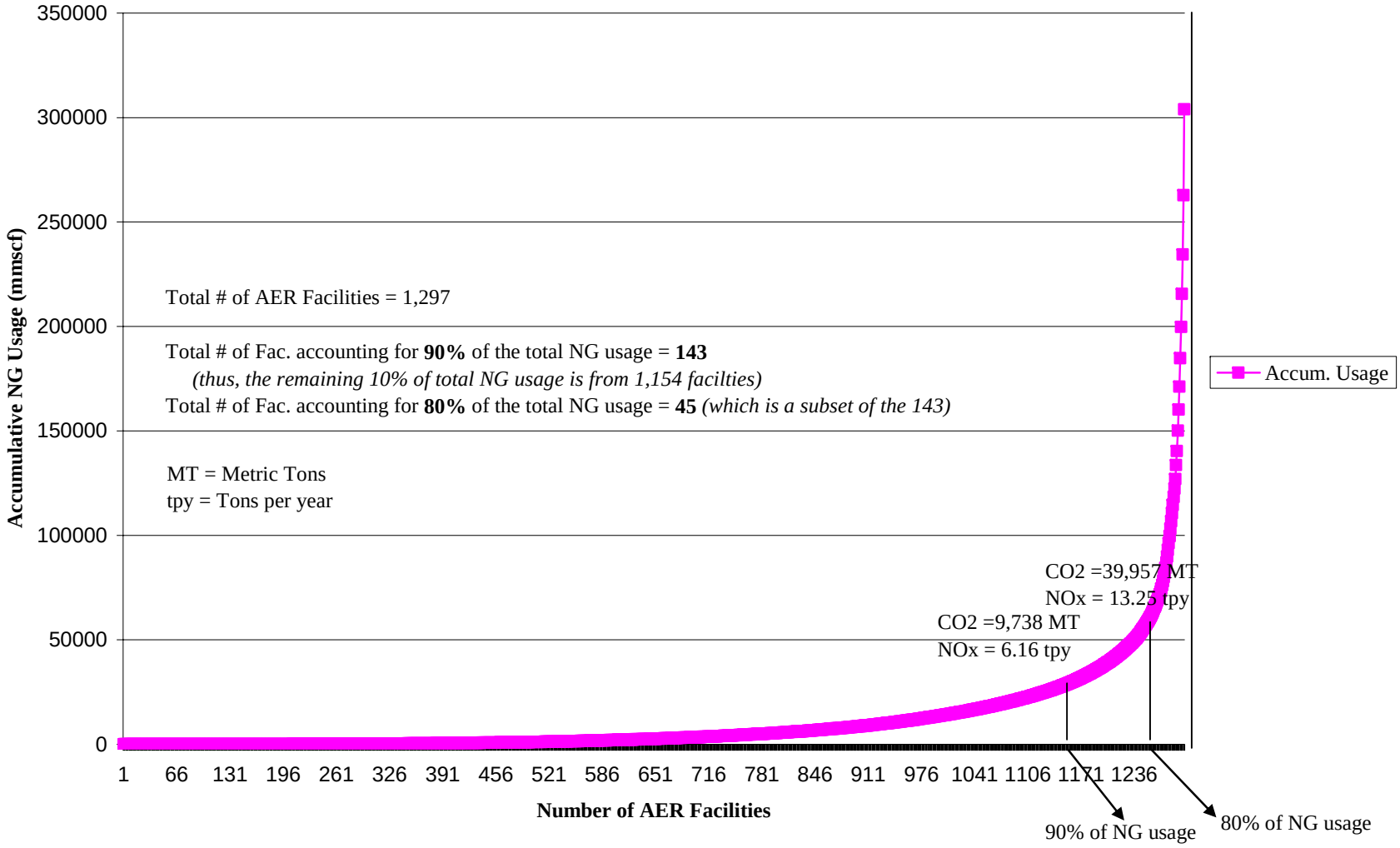


Table 3-3

URBEMIS Run Results for Residential/Commercial Projects Emitting Approximately 3,000 MTCO2 per Year*

			Area Source Emissions		*Operational Emissions*		**TOTAL**
	Weighted Avg Trip Rate	**Size**	**CO2 (tons/year)**	**CO2 (MT/year)**	**CO2 (tons/year)**	**CO2 (MT/year)**	**CO2 (MT/year)**
Res - Single Unit	19.54	80 units	326.86	297.15	3003.56	2730.51	3027.65
Res - Apt	9.17	175 units	422.70	384.27	2971.95	2701.77	3086.05
Comm - Office	6.02	265,000 ft^2	387.41	352.19	2961.75	2692.50	3044.69
Comm - Bank	206.22	9,500 ft^2	14.38	13.07	3192.90	2902.64	2915.71
Single/Apt	19.54	35 units	379.59	345.08	2964.82	2695.29	3040.37
	9.17	100 units					
Office/Bank	6.02	170,000 ft^2	254.19	231.08	3042.71	2766.10	2997.18
	206.22	3,400 ft^2					
Office/Single	6.02	135,000 ft^2	355.13	322.85	2956.32	2687.56	3010.41
	19.54	40 units					
Office/Apt	6.02	135,000 ft^2	403.19	366.54	2952.34	2683.95	3050.48
	9.17	85 units					
Bank/Single	206.22	3,700 ft^2	202.81	184.37	3052.93	2775.39	2959.76
	19.54	50 units					
Bank/Apt	206.22	4,000 ft^2	248.12	225.56	3042.64	2766.04	2991.60
	9.17	100 units					
Single/Apt/Office	19.54	20 units	382.60	347.82	2945.26	2677.51	3025.33
	9.17	65 units					
	6.02	100,000 ft^2					
Single/Apt/Bank	19.54	20 units	241.78	219.80	3020.76	2746.15	2965.95
	9.17	65 units					
	206.22	3,550 ft^2					
						Avg CO2 (MT/year):	**3009.60**

*****Offsite electricity use, water use, or other potential life cycle emissions not included.

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As shown in Table 3-3, this threshold would represent a residential development of about 70 single-family dwelling units. It should be noted that the sensitivity analysis did not include GHG emissions from electricity use and water use. As a result, similar to the earlier discussion of industrial projects, this screening level of 3,000 MTCO2eq/yr could capture development projects less than 70 single-family dwelling units.

In CAPCOA's White Paper, it is suggested that a thresholds of 900 MTCO2eq/yr would capture 90 percent of all development projects, which should translate into at least 90 percent of GHG emissions from the residential and commercial sectors[2]. According to CAPCOA 900 MTCO2eq/yr equates to approximately 50 single-family dwelling units. This information appears to corroborate the SCAQMD staff's finding that the policy objective of capturing 90 percent of all GHG emissions for this region can be achieved with a screening level of 3000 MTCO2eq/yr. Therefore, staff is recommending that this value be used by lead agencies for residential and commercial developments, including industrial parks, warehouses, etc.

- **Tier 4 – Decision Tree Options:** consists of three decision tree options to demonstrate that a project is not significant for GHG emissions. The three compliance options are as follows.

  Compliance Option 1 – the lead agency would calculate GHG emissions for a project using a BAU methodology. Once GHG emissions are calculated, the project proponent would need to incorporate design features into the project and/or implement GHG mitigation measures to demonstrate a 30 percent reduction from BAU. Although a 30 percent reduction below BAU is consistent with the target objectives of AB 32, it will continue to reduce GHG emissions beyond 2020, thus, contributing to GHG reductions pursuant to the Governor's Executive Order S-3-05 (a 90 percent reduction compared to current GHG emissions). A 30 percent reduction is also considered to be an achievable GHG reduction target based on current technologies.

  Compliance Option 2 – this option consists of early compliance with AB 32 through early implementation of CARB's Scoping Plan Measures. The intent of this compliance option is to accelerate GHG emission reductions from the various

[2] Although the CAPCOA White Paper implies that 900 metric tons per year equates to a 90 percent capture rate, there is no explicit information provided in the White Paper that demonstrates this correlation. Indeed, the CAPCOA authors state that 900 metric tons, which represents approximately 50 residential units, corresponds to widely divergent capture rate percentile rankings depending on the project location (see discussion on page 43 of the White Paper). Percentile rankings were based on a survey of four cities in California. A project of 900 metric tons per year representing a 90 percent capture rate appears to be a working assumption for which there appears to be no factual basis. Further, although not explicitly stated, it is assumed that the 900 metric tons were derived using the URBEMIS2007 model. It should be noted that that the URBEMIS2007 model only quantifies CO2 emissions and direct emissions primarily from on-road mobile sources. It does not capture other GHG pollutants or indirect GHG emissions such as emissions from energy generation, water conveyance, etc. Therefore, it is likely that a 50-unit residential project would actually generate higher GHG emissions than 900 metric tons per year.

sectors subject to CARB's Scoping Plan to eliminate GHG emission, especially for those GHGs that have a long atmospheric lifetime such as CO2, sulfur hexafluoride, etc., to minimize future projected impacts to California from global climate change.

Compliance Option 3 – this compliance option consists of establishing sector-based performance standards. For example, it may be possible to use the 1990 inventory required under AB 32 to establish an efficiency standard such as pounds per person, pounds per worker, pounds per square feet, pounds per item manufactured, etc. When calculating GHG emissions from a project, if they are less than the established efficiency standard the project would not be significant relative to GHG emissions, while projects exceeding the efficiency standard would be significant.

If the lead agency or project proponent cannot achieve the performance standards on any of the compliance options in Tier 4, GHG emissions would be considered significant.

- **Tier 5** – under this tier, the lead agency would quantify GHG emissions from the project and the project proponent would implement offsite mitigation (GHG reduction projects) or purchase offsets to reduce GHG emission impacts to less than the proposed screening level. In addition, the project proponent would be required to provide offsets for the life of the project, which is defined as 30 years. If the project proponent is unable to obtain sufficient offsets, incorporate design features, or implement GHG reduction mitigation measures to reduce GHG emission impacts to less than the screening level, then GHG emissions from the project would be considered significant. Since it is currently uncertain how offsite mitigation measures, including purchased offsets, interact with future AB 32 Scoping Plan measures, the AQMD would allow substitution of mitigation measures that include an enforceable commitment to provide mitigation prior to occurrence of emissions and to prevent mitigating the same emissions twice.

  Mitigation Preference – If a project generates significant adverse impacts, CEQA Guidelines §15126.4 requires identification of mitigation measures to minimize potentially significant impacts. Because GHG emissions contribute to global change, mitigation measures could be implemented locally, nationally, or internationally and still provide global climate change benefits. Because reducing GHG emissions may provide co-benefits through concurrent reductions in criteria pollutants, when considering mitigation measures when the AQMD is the lead agency under CEQA, staff will implement mitigation measures that are real, quantifiable, verifiable, and surplus in the following order of preference.

  - Incorporate GHG reduction features into the project design, e.g., increase a building's energy efficiency, use materials with a lower global warming potential than conventional materials, purchase building materials locally, etc.

  - Implement onsite measures that provide direct GHG emission reductions onsite, e.g., replace onsite combustion equipment (boilers, heaters, steam

generators, etc.) with more efficient combustion equipment, replace existing high global warming potential refrigerants with low global warming refrigerants, eliminate or minimize fugitive emissions, etc.

- Implement neighborhood mitigation measure projects that could include incentives for installing solar power, increasing energy efficiency by exceeding Title 24 building standards through replacing low efficiency water heaters with high efficiency water heaters, increasing building insulation, using fluorescent bulbs, replacing old inefficient refrigerators with efficient refrigerators using low global warming potential refrigerants, etc.

- Implement in-district mitigation measures such as any of the above identified GHG reduction measures; reducing vehicle miles traveled (VMT) through greater rideshare incentives, transit improvements, etc.

- Implement in-state mitigation measures, which could include any of the above measures.

- Implement out of state mitigation measure projects, which may include purchasing offsets if no other options are available.

CARB's Interim GHG Significance Threshold Proposal

In October 2008 CARB released its interim GHG significance threshold proposal and held a public workshop on October 27, 2008. CARB's threshold is considered to be an interim threshold because CARB staff intends to periodically review and change its threshold proposal as necessary. CARB's Preliminary Draft Staff Proposal (Proposal) states that non-zero GHG significance thresholds can be supported by substantial evidence. Futher, different GHG significance thresholds may be established for different sectors. Therefore, as part of its initial interim GHG significance threshold proposal CARB is proposing two separate GHG significance thresholds, one for new industrial projects and another for residential/commercial projects subject to CEQA. CARB's proposal uses a tiered approach (see Table 3-4).

Table 3-4
Comparison of CARB's and AQMD's Interim GHG Significance Thresholds Approaches

	Stationary/Industrial Sector Projects		Residential/Commercial Sector Projects	
	CARB	AQMD	CARB	AQMD (Not Recommended at this Time)
Policy Objective	Capture 90% of statewide stationary project emissions	Capture 90% of district wide GHG emissions (industrial)	Capture X% of statewide residential/commercial project emissions	Capture 90% of district wide residential/commercial project GHG emissions
Exemption	Apply applicable exemption	Apply applicable exemption	Apply Applicable Exemption	Apply Applicable Exemption
Regional GHG Reduction Plan	N.A.	Project Consistent with Applicable GHG Reduction Plan with GHG inventorying, monitoring, enforcement, etc.	Project Consistent with Applicable GHG Reduction Plan with GHG inventorying, monitoring, enforcement, etc.	Project Consistent with Applicable GHG Reduction Plan with GHG inventorying, monitoring, enforcement, etc.
Thresholds	Project < 7,000 MTCO2eq/yr & meets construction & transportation performance standards	GHG emissions from industrial project is < 10,000 MTCO2eq/yr, includes construction emissions amortized over 30 years & added to operational GHG emissions	Project meets construction & operation performance tandards, e.g., energy, water use, waste & ransportation & < X MTCO2eq/yr	Project is < 3,000 MTCO2eq/yr & exceeds Title 24 Energy Efficiency Standards by X%, if applicable – construction emissions amortized over 30 years & added to operational GHG emissions
Performance Standards	See above	NA	See above	3 Compliance Options: 1) Reduce GHG emissions 30% below BAU; 2) Early Implement AB 32 Measure; 3) Comply with Performance Standard
Offsets	Offsite substitution allowed	Implement offsite mitigation for life of project, i.e., 30 years, with mitigation preference	Offsite substitution allowed	Implement offsite mitigation for life of project, i.e., 30 years with mitigation preference
Determination	GHG emissions significant, EIR is prepared, if meeting none of the above	GHG emissions significant, EIR is prepared, if meeting none of the above	GHG emissions significant, EIR is prepared, if meeting none of the above	GHG emissions significant, EIR is prepared, if meeting none of the above

CARB's interim GHG significance threshold for industrial sources was developed to capture "the vast majority (~90% statewide) of the GHG emissions from new industrial projects being subject to CEQA's requirement to impose feasible mitigation." According to CARB's Proposal, CARB staff used data from a survey of industrial boilers performed by the Oak Ridge National Laboratory in which it was concluded that small boilers with an input capacity of 10 MMBtu/hr corresponded to 93 percent of total industrial boiler input capacity, or 4,660 MTCO2e/yr. Using this result and accounting for process losses, purchased electricity, and water usage and wastewater discharge, CARB staff is recommending 7,000 MTCO2eq/yr as a GHG significance threshold for industrial projects. The following bullet points summarize CARB's proposed interim GHG significance threshold for industrial sources.

- Box 1 – Apply any applicable categorical or statutory exemptions. If the project does not qualify for an exemption, move to Box 2.

- Box 2 – The industrial project must meet both of the following performance standards or equivalent mitigation measures to be deemed insignificant for GHGs:

    - Construction – Project must meet an interim performance standard for construction- related emissions (performance standard not yet defined).

    - Transportation – Project must meet an interim performance standard for transportation (performance standard not yet defined).

    AND

    - Project with mitigation will emit no more than 7,000 MTCO2eq/yr. If the project does not qualify for either of the performance standards or exceeds 7,000 MTCO2eq/yr, move to Box 3.

- Box 3 – Project is deemed significant and an EIR must be prepared.

- CARB's Preliminary Draft Proposal for Residential and Commercial projects is summarized in the following bullet points.

- Box 1 – Apply any applicable categorical or statutory exemptions. If the project does not qualify for an exemption, move to Box 2.

- Box 2 – Project complies with a previously approved plan that addresses GHG emissions and must: include a GHG reduction target consistent with AB 32; be consistent with transportation-related target adopted by CARB pursuant to SB 375; include a GHG inventory and mechanism for monitoring GHG emissions; include enforceable GHG requirements; include a mechanism for periodic updates to plan; and have a certified CEQA document. If the project is

consistent with a GHG plan that includes all of these elements, it is presumed to be insignificant for GHGs. If the project is not consistent with a GHG plan or there is no adopted GHG plan that includes all of the above elements, move to Box 3.

- Box 3 – The residential/commercial project must meet all of the following performance standards or equivalent mitigation measures to be deemed insignificant for GHGs:

  - Construction – Project must meet an interim performance standard for construction- related emissions (performance standard not yet defined).

  - Operations – Project must meet the following performance standards: energy use performance standard defined in CEC's Tier II Energy Efficiency goal; an interim performance standard for water use (performance standard not yet defined); an interim performance standard for waste (performance standard not yet defined); and an interim performance standard for transportation (performance standard not yet defined).

AND

The project with performance standards or equivalent mitigation will emit no more than X MTCO2eq/yr (criterion to be developed). If the project does not qualify for any one of the performance standards or exceeds X MTCO2eq/yr, move to Box 4.

- Box 4 – Project is deemed significant and an EIR must be prepared.

For a detailed description of CARB's interim GHG significance threshold proposal, refer to the following URL: http://www.arb.ca.gov/cc/localgov/ceqa/meetings/102708/prelimdraftproposal102408.pdf.

CARB is currently accepting comments on its Draft Proposal and has scheduled a second public workshop on December 9, 2008. CARB staff currently anticipates taking their proposal to their Board in February 2009.

CHAPTER 4

CONSIDERATIONS WHEN ANALYZING GHG EMISSIONS

Introduction

GHG Analysis Recommendations

INTRODUCTION

As noted in Chapter 1, on June 19, 2008, OPR, in collaboration with the California Resources Agency, the California Environmental Protection Agency and the California Air Resources Board, released a *Technical Advisory* containing informal guidance for public agencies as they address the issue of climate change in their CEQA documents. With regard to analyzing GHG emission impacts OPR states,

"Each public agency that is a lead agency for complying with CEQA needs to develop its own approach to performing a climate change analysis for projects that generate GHG emissions. A consistent approach should be applied for the analysis of all such projects, and the analysis must be based on best available information… Lead agencies should determine whether greenhouse gases may be generated by a proposed project, and if so, quantify or estimate the GHG emissions by type and source."

Other than this general advice, the *Technical Advisory* does not provide explicit details for quantifying GHG emissions.

CAPCOA's White Paper provides a comprehensive discussion of modeling tools that are currently available for analyzing GHG emissions[3]. As indicated in the White Paper, no one model is currently available that is capable of estimating all of a project's direct and indirect GHG emissions. It is likely, however, that the Urban Emissions (URBEMIS) Model will be the most commonly used model for calculating GHG emissions because it currently calculates CO2 emissions (in addition to criteria pollutant emissions) during both construction and operation of proposed projects, it is publicly available, and already widely used in California. Statewide use of the URBEMIS model would provide consistency throughout California with regard to quantifying GHG emissions. For a list of currently available models that calculate GHG emissions and summaries of the capabilities, advantages, and disadvantages of each model refer to Table 10 on pages 75 through 78 in the CAPCOA White Paper.

The purpose of this chapter is to provide more explicit guidance to CEQA practitioners with regard to quantifying GHG emissions than OPR's *Technical Advisory*, while building on the information provided CAPCOA's White Paper.

GHG ANALYSIS RECOMMENDATIONS

Direct/Indirect Impacts

As noted in Chapter 3 of this Guidance Document, consistent with CEQA, indirect and direct impacts of the project, typically within California, are required to be analyzed in the CEQA document for a proposed project. The analysis of direct GHG impacts is

[3] For maximum transparency with regard to quantifying GHG emissions and disclosure to the public, SCAQMD staff recommends using only publicly available models.

relatively straightforward as onsite GHG sources or directly related offsite GHG sources, such as worker commute trips, are generally readily identifiable. Indirect GHG emission sources are less obvious, but may include some of the sources identified in the following paragraphs. In general, for most projects information on direct and indirect emissions may be available, rather than a full life-cycle analysis of emissions. The lead agency has typically been expected to address emissions that are closely related and within the capacity of the project proponent to control and/or influence.

Direct Impacts - are primary effects that are caused by a project and occur at the same time and place, such as emissions from boilers, heaters, or other onsite emissions sources. Direct impacts generated by a project may include offsite sources directly related to the project such as emissions from worker commute trips, haul truck trips to import raw materials and/or export finished products or other goods. The following paragraphs provide general guidance on quantifying direct GHG emissions.

CAPCOA's White Paper provides a comprehensive discussion of modeling tools that are currently available for analyzing GHG emissions. Further, no one model is currently available that is capable of estimating all of a project's direct and indirect GHG emissions. Although there are a number of modeling tools available to calculate GHG emissions the following discussion focuses on a combination of approaches using the URBEMIS model as the basis for analyzing GHG emission impacts. Other approaches for calculating GHG emissions can be used, as long as they are supported by scientific evidence and include publicly available information.

The URBEMIS model is a publicly available model that is currently used statewide to calculate criteria pollutant emissions from construction and operation activities for a wide variety of land use projects. The model is regularly updated through a collaboration of air pollution control agencies, including the SCAQMD, to reflect the most current data, methodologies, and emission factors for quantifying criteria pollutant emissions. The most current update to the model is URBEMIS2007 version 9.2.4, which quantifies CO2 emissions in addition to criteria pollutant emissions.

Currently, there are several disadvantages to using the URBEMIS model to calculate GHG emissions from a proposed project and, as a result, it should not be the only tool used to calculate GHG emissions. For example, currently the URBEMIS model only quantifies CO2 emissions and not other GHG pollutants, with the exception of methane from mobile sources, which is converted to CO2eq. emissions. Since CO2 emissions comprise the bulk of GHG emissions from most projects, URBEMIS GHG results are fairly representative of GHG emissions from a project.

To quantify mobile source emissions from on-road mobile sources, the URBEMIS model uses trip rate information from the Institute of Transportation Engineers Trip Generation Handbook (ITE, 2001) as the trip rate default factor for all land uses. ITE trip rate information is widely used and is considered legally defensible as they rely on substantial reports and surveys of trip rates in cities with little or no transit. As a result, the ITE trip rates are also considered to provide a conservative estimate of trip

rates and associated emissions. The model, however, treats each trip as a separate trip and doesn't consider that a single trip may be used for more than one purpose, referred to as "internalization." The model also does not fully account for interaction between land uses in its estimation of mobile source operational emissions. URBEMIS does allow the user to overwrite the default trip rates and characteristics with more project-specific data from a traffic study prepared for a project.

In spite of the disadvantages of the URBEMIS model described above, it can be used as the first step in quantifying GHG emissions for typical land use projects because it establishes default parameters for the most common emission sources from a project including construction equipment types and activity profiles, area of site disturbed during construction, building size, number vehicle trips, etc., if the level of information about the project is low. If more information about the project is available such as a precise profile of construction equipment and activity levels, number of vehicle trips based on a traffic study prepared for the project, etc., this information can be incorporated into the model. The model can then quantify CO2 emissions from both construction and operation.

The URBEMIS construction analysis quantifies criteria pollutant and CO2 emissions from both off-road sources (primarily construction equipment) and on-road sources (worker commute trips, haul truck trips, etc.). To further flesh out the construction analysis, the lead agency would have to identify emission factors for other GHG pollutants likely to be emitted during construction, i.e., methane and nitrous oxide[4], for both off-road and on-road emissions sources and then quantify the GHG emission results using spreadsheets or other available tools.

The off-road CO2 emission factors in the URBEMIS model are generated from CARB's off- road model (http://www.arb.ca.gov/msei/offroad/offroad.htm). Methane emission factors for off-road equipment can also be obtained from CARB's OFFROAD2007 model. CO2 and methane emission factors for off-road equipment that are based on CARB's OFFROAD2007 model can also be found on the SCAQMD's CEQA webpages at the following URL: http://www.aqmd.gov/ceqa/handbook/offroad/offroad.html. Other sources of off-road GHG emissions factors for equipment used in California may be used, as long as they are supported by scientific evidence and are publicly available.

The URBEMIS model is able to quantify mobile source CO2 emissions during construction from on-road mobile sources such as construction worker commute trips, heavy-duty truck trips to haul away demolition debris, soil hauling to and from the site etc., and during operation, primarily vehicle trips using ITE's Trip Generation Manual (ITE, 2001). The on-road CO2 emission factors in the URBEMIS model for both construction and operation are generated from CARB's on- road mobile source emissions model, EMFAC2007 (http://www.arb.ca.gov/msei/onroad/onroad.htm). Methane emission factors for on-road mobile sources can also be obtained from

[4] Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are not combustion emissions, so would not normally be emitted during construction.

CARB's EMFAC2007 model. CO2 and methane emission factors for on-road mobile sources that are based on CARB's EMFAC2007 model can also be found on the SCAQMD's CEQA webpages at the following URL: http://www.aqmd.gov/ceqa/handbook/onroad/onroad.html.

The analysis of operation emissions from all types of land uses in the URBEMIS model focuses primarily on mobile source emissions and some area sources. The model does not quantify emissions from stationary sources. For stationary sources that require a permit from the SCAQMD, emission calculation procedures and methodologies are available in the SCAQMD's Best Available Control Technology Guidelines (http://www.aqmd.gov/bact/partd7-9-2004update.pdf). Examples of facilities that use stationary sources requiring a permit from the SCAQMD include: fossil fuel power plants[5], cement plants, landfills, wastewater treatment plants, gas stations, dry cleaners and industrial boilers. The SCAQMD has procedures and methodologies for projects subject to SCAQMD permits to calculate criteria pollutants and air toxics. It is anticipated that these same procedures and methodologies could be extended to estimate a permitted facility's GHG calculations. For are any stationary and area sources that do not require SCAQMD permits, the same methodologies used for permitted sources could be used. It will be necessary to contact the SCAQMD to obtain information on GHG emission calculation methodologies applicable to stationary source equipment.

Indirect Impacts - Indirect or secondary effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems (CEQA Guidelines §15358)(a)(2)). The examples of facilities that use stationary sources requiring a permit from the SCAQMD that may contribute to direct environmental impact (fossil fuel power plants, cement plants, landfills, wastewater treatment plants, gas stations, dry cleaners and industrial boilers) may also contribute to indirect impacts and, therefore, should be included, as necessary in the CEQA analysis of GHGs.

Quantification Methodologies and GHG Emission Factors

Methodologies for calculating GHG emissions and GHG emission factors are currently not readily available. Until such time as GHG calculation methodologies and emission factors become well established and more readily available, lead agencies may want to consult the following references to identify acceptable methodologies and emission factors.

1. The first useful reference for GHG emission factors for stationary sources is EPA's Air Pollutant (AP)-42, which is a compilation of air pollutant emission

[5] According to CEQA Guidelines §15227, CEQA does not apply to projects outside of California. The California Attorney General's Office has rendered an opinion stating that the definition of the environment in CEQA does not stop at the borders of California. Further, California public agencies that take an action outside of California is still bound by the requirements of CEQA to prepare an EIR if the action may cause a significant effect on the environment.

factors for stationary point and area sources. Each of the first 13 chapters of AP-42 is dedicated to a specific source activity such as solid waste disposal, petroleum industry, and metallurgical industry. Since the publication of the fifth edition (and supplementals) in 2001, there have been a number of updates to the various specific stationary sources such as hot asphalt plants, organic liquid storage tanks, and coke production. In addition to the criteria pollutant emissions, some of the updated AP-42 chapters provide GHG emission factors for a variety of sources. For example, Chapter 15 of AP-42 focuses on GHG emissions from biogenic sources such as soils, termites, lightning, and enteric fermentation (animal digestive fermentation).

2. Second, the California Climate Action Registry (C-CAR) has prepared a General Reporting Protocol (GRP), which is a relatively easy-to-follow user's manual that outlines the principles, concepts, calculation methodologies and procedures required for effective participation in the California Registry. The appendices of the GRP provide GHG emissions factors, specifically CO2, CH4 and N2O, for electricity use, mobile combustion and stationary combustion based on fuel usage type.

3. Third, a thorough internet search should be conducted to find reliable sources of emissions factors that would assist in accurately determining GHG emissions from a specific source being evaluated. Again, all potential GHGs, such as CO2, CH4 and N2O, should be evaluated to the best of one's ability to locate dependable information.

4. Finally, a material balance approach also may provide reliable average emission estimates for specific sources. A material balance is when one accounts for (or "balances") all the materials going into and coming out of the process in order to make a credible emissions estimation. For some sources, a material balance may provide a better estimate of emissions especially in situations where a high percentage of material is lost to the atmosphere (e. g., sulfur in fuel, or solvent loss in an uncontrolled coating process.) In other cases, material balances may be inappropriate where material is consumed or chemically combined in the process, or where losses to the atmosphere are a small portion of the total process throughput.

Reporting GHG Emissions – Daily vs. Annual Emissions

The analysis of GHGs is a much different analysis than the analysis of criteria pollutants for the following reasons. For criteria pollutants, significance thresholds are based on daily emissions because attainment or non-attainment is based on daily exceedances of applicable ambient air quality standards. Further, several ambient air quality standards are based on relatively short term exposure effects on human health, e.g., one-hour and eight-hour. Since the half-life of CO2 is approximately 100 years, the effects of GHGs are longer-term, affecting global climate over a relatively long time frame (see also Table 3-1).

Typical GHG emission inventories (EPA5, ARB6, etc.) represent directly emitted GHGs during a given year. As a result, the current convention is to present GHG emissions as annual emissions. The URBEMIS model can be set to calculate annual emissions for a project. When using the URBEMIS model to calculate annual GHG emissions, it may be useful to modify the trip rate for each land use using a weighted trip rate average to more accurately reflect annualized trip rates. A weighted trip rate average reflects the trip rates during the week, as well as trip rates during Saturdays and Sundays. Trip rate information for weekdays and weekend days can be found in the ITE Trip Rate Handbook.

CHAPTER 5

CONCLUSION

Introduction

Future Action Items

INTRODUCTION

CEQA Guidelines §15064.7(a) encourages lead agencies to establish thresholds of significance to determine the significance of an environmental impact. Further, thresholds of significance to be adopted for general use as part of the lead agency's environmental review process must be adopted by ordinance, resolution, rule, or regulation, and developed through a public review process and be supported by substantial evidence (CEQA Guidelines §15064.7(b)). Staff's proposed interim GHG significance threshold proposal has been developed through a public process consisting of a series of Stakeholder Working Group meetings. Staff proposals have been modified over time based on written and oral feedback from the Working Group. Staff's intent was to reach consensus to the extent feasible, but for some items staff could not find common ground with some of the stakeholders.

The next immediate step for SCAQMD staff is to present a final interim GHG significance threshold proposal to the SCAQMD Governing Board for consideration. If the Governing Board approves staff's final interim GHG significance threshold proposal, then staff will embark on a number of short-term and intermediate term activities to provide outreach to public agencies that might use staff's interim GHG significance threshold to determine whether or not their projects' GHG emissions are significant, periodically revisit and revise as necessary the interim proposal, and accommodate stakeholders' requests for more information on GHG calculation methodologies and mitigation measures. The following sections provide discussions on future anticipated action items

FUTURE ACTION ITEMS

Interim GHG Significance Threshold Outreach Program

It is currently anticipated that staff's interim GHG significance threshold proposal will be presented to, and considered by the Board at the November 7, 2008 public hearing. Consistent with other significance threshold proposals adopted by the Governing Board, if the draft GHG significance threshold proposal is adopted, staff will meet with local cities, councils of governments, and leagues of cities to discuss the staff proposal and address any questions or concerns.

Once the interim GHG significance threshold is adopted, this Guidance Document will be posted on the SCAQMD's CEQA web pages. Staff will also send notice of the adoption of the staff proposal to all agencies, organizations, and individuals on the SCAQMD's CEQA "Interested Parties" mailing list. In addition, it is expected that staff will prepare and make available an informational brochure that summarizes information about the interim GHG significance proposal in addition to this Guidance Document.

Starting in January 2009, as part of its intergovernmental review (IGR) responsibilities under CEQA, where the SCAQMD reviews and CEQA documents prepared by other public agencies, SCAQMD will begin more thorough evaluations of CEQA documents with regard to their GHG analyses and the basis by which they make a determination of significance. Staff will begin recommending use of the staff's interim GHG significance threshold proposal or other available GHG significance thresholds based on substantial evidence in comment letters on notices of preparation of an EIR. As of March 1, 2009, staff will formally recommend use of staff's interim GHG significance threshold proposal or other available GHG significance thresholds based on substantial evidence in comment letters on NDs and MNDs. As of July 1, 2009, staff will formally recommend use of staff's interim GHG significance threshold proposal or other available GHG significance thresholds based on substantial evidence in comment letters on EIRs.

Compile Lists of GHG Design Features and Mitigation Measures

CEQA Guidelines §15126.4 requires an EIR to "describe feasible measures which could minimize significant adverse impacts, including where relevant, inefficient and unnecessary consumption of energy." Ideally, it is desirable to avoid impacts altogether through incorporating design features into the proposed project. Because staff's recommended interim GHG significance threshold includes performance standards (see tier 4 compliance options 1 and 3) or a project proponent may try to reduce GHG emissions to less than the applicable screening levels, mitigation measures or design features are important components of the overall GHG significance threshold strategy. As a result, a number of GHG Working Group stakeholders has requested that SCAQMD compile lists of design features or mitigation measures to assist with reducing GHG emissions for all land use types.

In response to the request from GHG Working Group stakeholders to develop GHG design features and mitigation measures, over the next year SCAQMD staff will compile lists of GHG reduction strategies, including control efficiencies, by sector and make the lists available online with other recommended mitigation measures. There is already a robust body of mitigation measures available (see in particular the CAPCOA bullet point discussion below), but in most cases, they do not include control efficiencies. SCAQMD staff will use the following mitigation sources as a basis from which to compile mitigation strategies.

- **CEQA Guidelines, Appendix F –** this appendix includes a list of general energy conservation measures that may be used as a basis to identify GHG reduction strategies. The measures do not contain GHG control efficiencies, so they would need further review to determine if control efficiencies are available.

- **CAPCOA White Paper –** this document provides a comprehensive discussion of GHG reduction strategies and specific mitigation measures are listed in Table 16 in Appendix B. The mitigation measures are grouped by emissions source type, such as transportation measures, parking measures, commercial and residential design features, etc. Table 16 also provides other useful information about each

mitigation measure including source of each measure, comments and descriptions about each control measure, etc. Most importantly, for many of the mitigation measures CAPCOA has included an emission reduction score. In most cases, the emission reduction score is given as a range. As a result, further evaluation would be necessary to provide a single more precise emission reduction score or a defensible average. Otherwise, it is likely that the high end of the emission reduction score would be used.

- **CARB -** is actively working to develop and adopt GHG protocols to support the Climate Change Program. CARB is working in collaboration with other agencies and organizations, including the California Climate Action Registry, to adopt consistent and standardized methods to accurately report GHG emissions. There are two kinds of GHG protocols, a reporting protocol and a project protocol. The project protocol may be useful as it sets standards and provides specific guidance to define GHG reduction projects and quantify and report GHG reductions from project activities. Some example protocols include manure management and urban forestry. It is expected that additional protocols will be developed and adopted by CARB. It is also expected that CARB's Scoping Plan may provide guidance on regulatory guidance that could be used to develop GHG emission reduction measures. GHG reduction strategies that may also serve as GHG mitigation measures to be developed by CARB over the next two years are shown in Table 5-1.

Table 5-1
California Air Resources Board GHG Emission Reduction Strategies

Strategy	Description of Strategy
Other Light Duty Vehicle Technology	New standards would be adopted to phase in beginning in the 2017 model year
Hydrofluorocarbon Reduction	1) Ban retail sale of HFC in small cans; 2) Require that only low global warming potential (GWP) refrigerants be used in new vehicular systems; 3) Adopt specifications for new commercial refrigeration; 4) Add refrigerant leak-tightness to the pass criteria for vehicular Inspection and Maintenance programs; 5) Enforce federal ban on releasing HFCs.
Transportation Refrigeration Units, Off-Road Electrification, Port Electrification	Strategies to reduce emissions from TRUs, increase off-road electrification, and increase use of shore-side/port electrification.
Manure Management	San Joaquin Valley Rule 4570 (adopted 6/15/06) reduces volatile organic compounds from confined animal facilities through implementation of control options.
Alternative Fuels: Biodiesel Blends	CARB would develop regulations to require the use of 1 to 4 percent biodiesel displacement of California diesel fuel.

Table 5-1 (Concluded)
California Air Resources Board GHG Emission Reduction Strategies

Strategy	Description of Strategy
Alternative Fuels: Ethanol	Increased use of ethanol fuel.
Heavy-Duty Vehicle Emission Reduction Measures	Increased efficiency in the design of heavy duty vehicles and an education program for the heavy duty vehicle sector.
Reduced Venting and Leaks in Oil and Gas Systems	Rule considered for adoption by the Air Pollution Control Districts for improved management practices.
Hydrogen Highway	The California Hydrogen Highway Network (CA H2 Net) is a State initiative to promote the use of hydrogen as a means of diversifying the sources of transportation energy.
Achieve 50% Statewide Recycling Goal	Achieving the State's 50 percent waste diversion mandate as established by the Integrated Waste Management Act of 1989, (AB 939, Sher, Chapter 1095, Statutes of 1989), will reduce climate change emissions associated with energy intensive material extraction and production as well as methane emission from landfills. According to the California Integrated Waste Management Board, in 2005 the statewide waste diversion rate was 52 percent.[6]
Landfill Methane Capture	Install direct gas use or electricity projects at landfills to capture and use emitted methane.
Zero Waste - High Recycling	Additional recycling beyond the State's 50% recycling goal.

- CEC and CPUC – These agencies are actively developing GHG emission reduction strategies that may also be used to develop GHG mitigation measures for specific energy production sources. Examples of CEC and CPUC GHG emission reduction strategies are shown in Table 5-2.

Other sources of potential GHG emission reduction measures will be evaluated and incorporated, as applicable into any GHG mitigation measure lists developed by the SCAQMD.

[6] CIWMB, 2007; http://www.ciwmb.ca.gov/LGCentral/Rates/Diversion/2005/Default.htm

Table 5-2
GHG Emission Reduction Strategies Implemented by CEC and CPUC

Strategy	Description of Strategy
ENERGY COMMISSION (CEC)	
Building Energy Efficiency Standards in Place and in Progress	Public Resources Code 25402 authorizes the CEC to adopt and periodically update its building energy efficiency standards (that apply to newly constructed buildings and additions to and alterations to existing buildings).
Appliance Energy Efficiency Standards in Place and in Progress	Public Resources Code 25402 authorizes the Energy Commission to adopt and periodically update its appliance energy efficiency standards (that apply to devices and equipment using energy that are sold or offered for sale in California).
Cement Manufacturing	Cost-effective reductions to reduce energy consumption and to lower carbon dioxide emissions in the cement industry.
Municipal Utility Strategies	Includes energy efficiency programs, renewable portfolio standard, combined heat and power, and transitioning away from carbon intensive generation.
Alternative Fuels: non-Petroleum Fuels	Increasing the use of non-petroleum fuels in California's transportation sector, as recommended in the CEC's 2003 and 2005 Integrated Energy Policy Reports.
PUBLIC UTILITIES COMMISSION (PUC)	
Accelerated Renewable Portfolio Standard (33 percent by 2020)	The Governor has set a goal of achieving 33 percent renewables in the State's resource mix by 2020. The joint PUC/Energy Commission September 2005 Energy Action Plan II (EAP II) adopts the 33 percent goal.
California Solar Initiative	The solar initiative includes installation of 1 million solar roofs or an equivalent 3,000 MW by 2017 on homes and businesses, increased use of solar thermal systems to offset the increasing demand for natural gas, use of advanced metering in solar applications, and creation of a funding source that can provide rebates over 10 years through a declining incentive schedule.
Investor-Owned Utility	This strategy includes energy efficiency programs, combined heat and power initiative, and electricity sector carbon policy for investor owned utility.

Periodically Review the Interim GHG Significance Threshold

SCAQMD staff will periodically review and revise staff's GHG proposal to incorporate applicable updated information on GHGs and GHG reduction strategies resulting from regulatory requirements or advances in technology. Some areas of the current proposal that may be reevaluated include the tier 3 screening levels, and the tier 4 compliance option 1 GHG reduction target objective. Further, staff will evaluate whether or not sector based performance standards can be developed for tier 4 compliance option 3.

If a statewide GHG significance threshold is developed by CARB, staff will review that threshold and report to the Governing Board by March 2009 considering such a

threshold for adoption.~~regarding any implementation issues and ways to transition into the recommended GHG significance threshold within six months of formal approval by the CARB Board~~.

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APPENDIX A

WORKING GROUP MEMBERS AND CONTRIBUTORS

WORKING GROUP MEMBERS AND AFFILIATION:

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APPENDIX B

SUMMARIES OF WORKING GROUP MEETINGS

WORKING GROUP MEETING #1 (APRIL 30, 2008)

At the first Working Group meeting SCAQMD staff presented the Working Group with a number of policy objectives and design criteria for consideration to establish the framework for developing a GHG significance threshold. Policy objectives include the following concepts. First, the GHG significance threshold should minimize environmental degradation, that is, it should not make impacts worse. To this end, it may be useful to develop a GHG significance threshold that achieves GHG emissions reductions that are consistent with the goals of AB 32 estimated to be approximately 30 percent reduction of GHG emissions from business-as-usual. Although CEQA or a GHG significance threshold established pursuant to CEQA may be useful tools in reducing GHG emissions, they would act in parallel with regulatory requirements, e.g., AB 32, but they do not replace them. As a result, there is no requirement that a GHG significance threshold must reduce GHG emissions consistent with AB 32 or EO S-3-05.

In addition to policy considerations, a number of GHG significance threshold design criteria were also considered. An important consideration in developing a GHG significance threshold is the potential administrative burden it may create on lead agencies through increased resource impacts such as increased costs and staff if the significance threshold is established too low. For example, a zero threshold might result in eliminating or substantially reducing the number of projects that qualify for a categorical exemption, a negative declaration, or a mitigated negative declaration. Other design considerations discussed included establishing a single GHG threshold, such as a "bright line" numerical threshold or multiple thresholds, such as the tiered approaches identified by CAPCOA, etc.

WORKING GROUP MEETING #2 (MAY 28, 2008)

At the second Working Group meeting, staff presented design criteria recommendations based on the discussion at the first Working Group meeting and correspondence received subsequent to the first Working Group meeting. With regard to analyzing life cycle GHG emissions, staff's initial recommendation was to exclude an analysis of life cycle emissions because life cycle process are not well established. Instead, the GHG emissions analysis should focus on direct and indirect impacts, consistent with current CEQA requirements (CEQA Guidelines §15064(d)). Feedback from the Working Group suggested that a CEQA analysis may be considered deficient without making an effort to conduct a life cycle analysis. Further, if life cycle emissions data are not available, the lead agency should note this consider further analysis speculative and terminate the discussion (CEQA Guidelines §15145).

Another design criteria recommendation made by staff was to take into consideration the administrative burden and resources impacts when establishing a GHG significance threshold. Staff recommended that the GHG significance threshold

should not be set too low, which could result in all projects going through the EIR process. It was pointed out that requiring an EIR for all projects does not necessarily result in more mitigation, no meaningful mitigation may be available for small projects, and it may provide a disincentive for implementing mitigation if the measures are unable to reduce GHG impacts to less than significant.

Other design criteria recommended by staff included analyzing the six Kyoto GHGs, any GHG significance threshold established would be considered interim and would be periodically evaluated and updated as necessary, etc. Staff also introduced the concept of preferred GHG mitigation strategies using a hierarchy from the most to least preferred strategies as shown below.

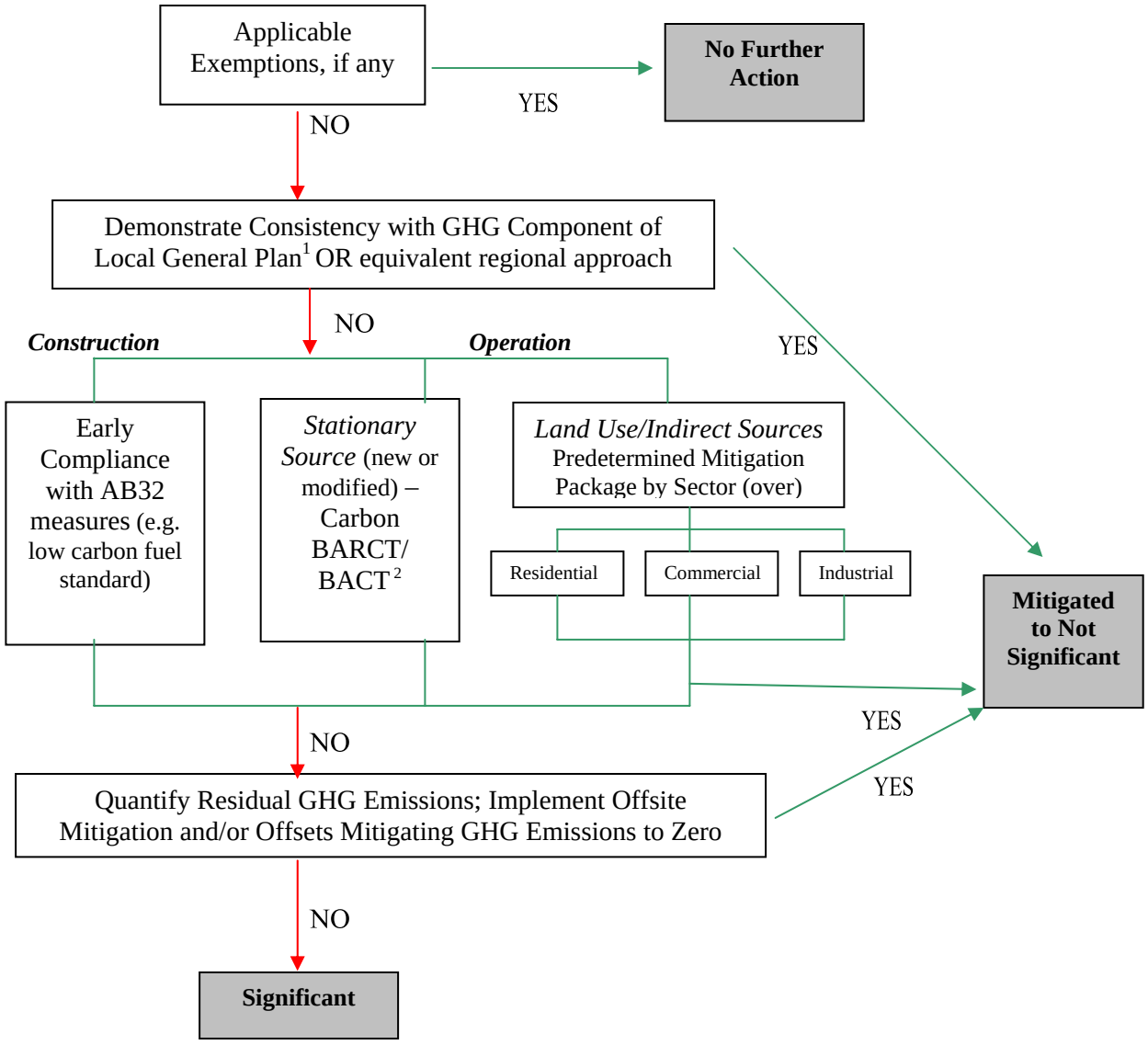
1. Incorporate GHG reduction strategies into project design
2. Mitigate GHGs from other onsite sources for modification projects
3. Mitigate offsite GHG emission reduction projects
4. Mitigate both construction & operational GHG impacts
5. Consider feasible mitigation based on economic factors (cost) pursuant to CEQA Guidelines §15364
6. Purchase acceptable GHG offsets with preference toward GHG reduction projects occurring in-basin or in-state (offset cost a consideration). The following points should be considered:
    a. Offset market still developing, so it is necessary to ensure offsets are obtained from a credible source
    b. Offsets should be provided for at least 10 years of project operation (see SJVAPCD indirect source Rule 9510 §6.2 mitigation requirements)

Finally, SCAQMD staff introduced the initial staff proposal. The initial staff proposal consisted of a tiered approach, similar to CAPCOA's Approach 2 with mandatory GHG mitigation measures. Each tier of this proposal is briefly described in the following bullet points and shown graphically in Figure B-1.

- The first tier consists of evaluating whether or not the project qualifies for any applicable exemption under CEQA. For example, SB 97 specifically exempts a limited number of projects until it expires in 2010. If the project qualifies for an exemption, no further action is required. If the project does not qualify for an exemption, then move to the next tier.

Figure B-1
Initial Staff Proposal – Proposed Tiered Approach – May 28, 2008

Significance determination of Cumulative Impacts from GHG emissions:



1. Local General Plans, at a minimum, must comply with AB32 reduction goals; have been analyzed under CEQA, and have a certified Final CEQA document; emission estimates approved by CARB or SCAQMD; include a GHG inventory tracking mechanism; and a commitment to remedy the excess emissions if AB32 goals are not met.

2. SCAQMD will work with CAPCOA to develop a list of mitigation measures.

- The second tier consists of determining whether or not the project is consistent with a GHG reduction plan that is part of a local general plan for example. The GHG reduction plan must, at a minimum, comply with AB 32 reduction goals; include emission estimates approved by CARB or SCAQMD, have been analyzed under CEQA, and have a certified Final CEQA document. Further, the GHG reduction plan must include a GHG inventory tracking mechanism; process to monitor progress in achieving GHG emission reduction targets, and a commitment to remedy the excess emissions if AB 32 goals are not met (enforcement). If the proposed project is consistent with the local GHG reduction plan, it is not significant for GHG emissions.

  The concept of consistency with a GHG reduction plan, is similar to the concept of consistency in CEQA Guidelines §15125(d). If the proposed project does not comply with the local GHG reduction plan or no GHG reduction plan has been adopted, then move to the third tier.

- Under the third tier there are three options that can be used to demonstrate that a project would not have significant emissions. The first significance option is early compliance with AB 32 Scoping Plan measures. The second significance option, primarily for stationary source equipment, would be to install carbon best available retrofit control technology (BARCT) or best available control technology (BACT). Carbon BARCT/BACT would be established by the SCAQMD. The third significance option for industrial, commercial, and residential land use projects would be to implement a menu of prescribed mitigation measures. Mitigation measures would be developed for each land use sector by SCAQMD staff. Implementing one of these three options would result in a determination that GHG emission impacts from the proposed project are not significant. If the proposed project is unable to implement any one of these three options or cannot fully implement any option, then it would move to the fourth tier.

- Under the fourth tier, the lead agency would quantify GHG emissions from the project and implement offsite mitigation (GHG reduction projects) or purchase offsets. Under this tier, GHG emission impacts the lead agency would be required to mitigate or offset GHG emissions to zero. If GHG emissions can be offset to zero, GHG emissions from the project are concluded to be insignificant. If GHG impacts cannot be reduced to zero, the project is concluded to be significant for GHGs.

WORKING GROUP MEETING #3 (JUNE 19, 2008)

Subsequent to Working Group meeting #2, SCAQMD staff received feedback on the initial staff proposal. Issues and concerns raised by the stakeholders on the initial staff proposal were addressed at the third Working Group meeting and are summarized in the following bullet points.

- The staff proposal does not explicitly state any quantitative or qualitative target objectives. If there are no explicit target objectives, how is it possible to determine whether or not a project is insignificant for GHG emissions?

- Concerns were raised regarding the lack of detail relative to the sector-specific mitigation measures and the potentially lengthy lag time between implementing the GHG significance threshold and developing the mitigation measures.

- For most projects, GHG emissions would not need to be calculated as long as the prescribed menu of sector-specific mitigation measures is implemented. Without quantifying GHG emissions and the control efficiencies of the mitigation measures, a project would be vulnerable to a "Fair Argument" that GHG emissions are still significant even after implementing prescribed mitigation measures.

- A CEQA document may be vulnerable in court if control efficiencies of mitigation measures are not identified.

- Is the staff proposal really a zero GHG significance?

  Based on Working Group feedback, staff presented revised staff proposal #1, which consisted of a tiered decision tree approach. The components of revised staff proposal #1 are described in the following bullet points and shown graphically in Figure B-2. As shown in Figure B-2, some of the tier components of the revised staff proposal are similar to those in the initial staff proposal.

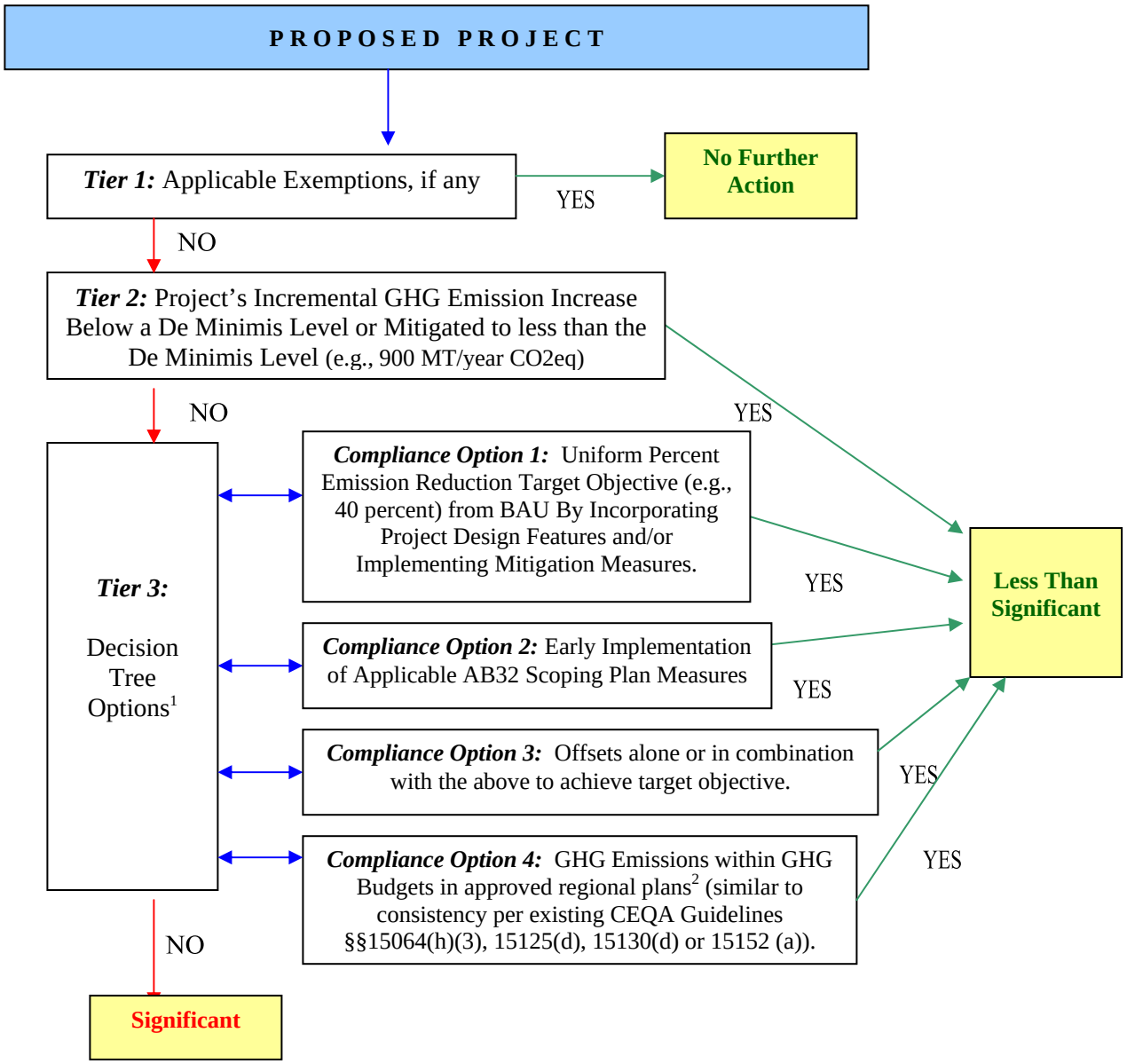
- **Tier 1 –** no change from the initial proposal.

- **Tier 2 –** is a new component of the revised staff proposal. Tier 2 attempts to identify small projects that would not likely contribute to significant cumulative GHG impacts. The de minimis or screening level of 900 metric tons per year is the level that is estimated by CAPCOA to capture 90 percent of the residential units or office space in pending application lists7. CAPCOA infers that projects that emit less than 900 metric ton per year would not likely be considered cumulatively considerable. Further, the 900 metric ton per year level would capture 90 percent

[7] Although the CAPCOA White Paper implies that 900 metric tons per year equates to a 90 percent capture rate, there is no explicit information provided in the White Paper that demonstrates this correlation. Indeed, the CAPCOA authors state that 900 metric tons, which represents approximately 50 residential units, corresponds to widely divergent capture rate percentile rankings depending on the project location (see discussion on page 43 of the White Paper). Percentile rankings were based on a survey of four cities in California. A project of 900 metric tons per year representing a 90 percent capture rate appears to be a working assumption for which there appears to be no factual basis. Further, although not explicitly stated, it is assumed that the 900 metric tons were derived using the URBEMIS2007 model. It should be noted that that the URBEMIS2007 model only quantifies CO2 emissions and direct emissions primarily from on-road mobile sources. It does not capture other GHG pollutants or indirect GHG emissions such as emissions from energy generation, water conveyance, etc. Therefore, it is likely that a 50-unit residential project would actually generate higher GHG emissions than 900 metric tons per year.

Figure B-2
Revised Staff Proposal #1 Tiered Decision Tree Approach – June 19, 2008

Significance Determination of Cumulative Impacts from GHG Emissions:



1. Substitution for equivalent reductions allowed.
2. Local General Plans or other local plans local plans that, at a minimum, comply with the overall target objective or the sector-based CARB Scoping Plan; have been analyzed under CEQA, and have a certified Final CEQA document; emission estimates approved by CARB or SCAQMD; include a GHG inventory; tracking mechanism; enforcement; and a commitment to remedy the excess emissions if commitments are not met.

of all pending projects, which means that 90 percent of all projects would have to implement GHG reduction measures.

If a project is less than 900 MT/year CO2eq or can mitigate to less than 900 MT/year CO2eq, it would be considered insignificant for GHGs. Projects larger than 900 MT/year CO2eq would move to tier 3.

- Tier 3 Decision Tree Options – consists of four decision tree options to demonstrate that a project is not significant for GHG emissions. The four compliance options are as follows.

  Compliance Option 1 – the lead agency would calculate GHG emissions for a project using a business-as-usual (BAU) methodology. Once GHG emissions are calculated, the project proponent would have to incorporate design features into the project and/or implement GHG mitigation measures to demonstrate a 40 percent reduction from BAU. A 40 percent reduction below BAU was selected for the following reason. To comply with the AB 32 requirement of reducing GHG emissions to 1990 levels, an approximately 30 percent reduction from current BAU is necessary.

  Since CEQA is not applicable to all GHG emission sources, i.e., existing projects that are not undergoing expansion or modifications, staff chose a 40 percent reduction below BAU requirement, which goes beyond the target GHG reduction objective of AB 32, but is still a potentially feasible GHG reduction for a variety of different projects.

  Compliance Option 2 – this option is the same as the early compliance with AB 32 option in the third tier of the initial staff proposal.

  Compliance Option 3 – this option is similar to the fourth tier of the initial staff proposal where GHG emissions would be reduced through offsite GHG reduction projects and/or use of offsets. This compliance option, however, would require offsetting GHG emissions by the same target objective as compliance option 1, that is, 40 percent below BAU instead of reducing GHG emissions to less than the de minimis or screening level.

  Compliance Option 4 – this option is the same as the consistency with the greenhouse gas reduction plan component in the second tier of the initial staff proposal.

  If the lead agency or project proponent cannot implement any of the compliance options in Tier 3, GHG emissions would be considered significant.

WORKING GROUP MEETING #4 (JULY 30, 2008)

Subsequent to Working Group meeting #3, SCAQMD staff received feedback on the revised staff proposal #1. Issues and concerns raised by the stakeholders on the initial

staff proposal were addressed at the third Working Group meeting and are summarized in the following bullet points.

- Compliance with a GHG reduction plan should not be a compliance option in Tier 3, but should be its own tier, earlier in the tiering process.

- There is a large disconnect between screening level and remaining emissions under the Tier 4 compliance options. For example, large projects that can reduce GHG emissions by the target objective of 40 percent would do so, which means GHG emissions would not be significant, could have substantially higher emissions than projects with GHG emissions less than the screening level.

- Compliance with a target objective should not be through offsets alone. Because of the uncertainties regarding the validity of offsets, preferred mitigation should consist of actual GHG emission reductions.

- The Tier 3 compliance option 1, GHG emissions reductions from BAU, is not the proper metric for determining significance. How can a lead agency be sure that the projected BAU emissions for a project are not artificially inflated to make it easier to achieve the required target objective?

- The Tier 3 compliance option 1, reducing GHG emission reductions from BAU, could penalize projects in environmentally progressive areas where BAU may be much lower than in other areas, thus, making it more difficult to achieve the target objectives.

Based on Working Group feedback and internal discussions, staff presented revised staff proposal #2, which further refined the previous tiered decision tree approach. The components of revised staff proposal #2 are described in the following bullet points and shown graphically in Figure B-3. As shown in Figure B-3, some of the tier components of the revised staff proposal are similar to those in the initial staff proposal.

- **Tier 1 –** no change from the initial proposal.

- **Tier 2 –** compliance option 4 in Tier 3 has been moved back a stand-alone tier.

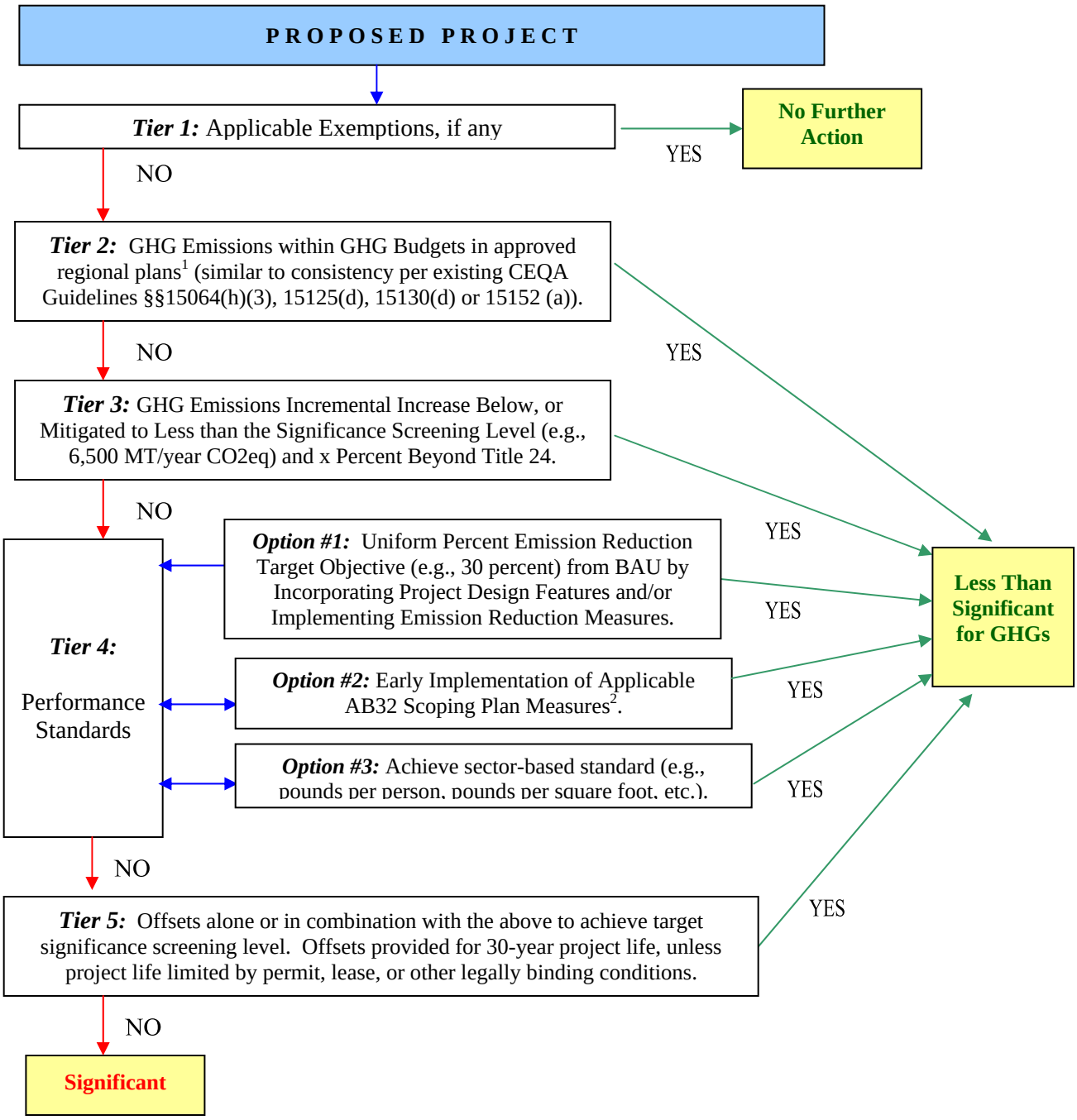
- **Tier 3 –** the screening level that was previously Tier 2 has been moved to Tier 3. In response to feedback from the Working Group, the screening level has been increased to 6,500 MT/year CO2eq. The new screening level was derived using the SCAQMD's existing NOx operational threshold as a basis. The daily NOx operational significance threshold, 55 pounds per day was annualized, which results in 10 tons of NOx per year. Using the URBEMIS2007 model, staff initially modeled a mixed-use project that emits just under 10 tons per year to determine what the equivalent CO2 emissions would be. Resulting CO2 emissions from the mixed use project were approximately 6,500 MT/year CO2. To further corroborate the 6,500 MT/year CO2 staff performed 19 modeling runs on a variety of projects including residential, commercial, industrial, and various combinations of land uses. In addition, since the analysis was an annual

analysis, a weighted trip rate was derived for each land use category to obtain a more accurate estimate of trip rates throughout the week. Although the results from the 19 modeling runs were approximately 16 percent higher than staff's original estimate of 6,500 MT/year CO2, 7,304 to 7,723 MT/year CO2, staff continued to recommend the 6,500 MT/year CO2 provides a margin of safety when deriving CO2 emissions based on the annualized NOx level of 10 tons per year and when evaluating different types of land use projects.

Projects with GHG emissions less than the screening level are considered to be small projects, that is, they would not likely be considered cumulatively considerable. However, because of the magnitude of increasing global temperatures from current and future GHG emissions, staff recommended that all projects must implement some measure or measures to contribute to reducing GHG emissions. Therefore, Tier 3 includes a requirement that all projects with GHG emissions less than the screening level must include efficiency components that reduce to a certain percentage beyond the requirements of Title 24 (Part 6, California Code of Regulations), California's energy efficiency standards for residential and nonresidential buildings.

- Tier 4 Performance Standards – Tier 3 from the revised staff proposal #1 has been moved to Tier 4 and renamed.

Figure B-3
Proposed Tiered Decision Tree Approach – July 30, 2008
Significance Determination of Cumulative Impacts from GHG Emissions:



1. Local General Plans or other local plans local plans that, at a minimum, comply with the overall target objective or the sector-based CARB Scoping Plan; have been analyzed under CEQA, and have a certified Final CEQA document; emission estimates approved by CARB or SCAQMD; include a GHG inventory; tracking mechanism; enforcement; and a commitment to remedy the excess emissions if commitments are not met.
2. Substitution for equivalent reductions allowed.

Compliance Option 1 – is essentially the same as the previously recommended, except that the target objective has been changed from reducing GHG emissions 40 percent below BAU to 30 percent below BAU to be more consistent with AB 32 target objectives.

Compliance Option 2 - – no change from the previous proposal.

Compliance Option 3 – this is a new compliance option and consists of establishing sector-based performance standards. For example, it may be possible to use the 1990 inventory required under AB32 to establish an efficiency standard such as pounds per person, pounds per worker, pounds per square feet, pounds per item manufactured, etc. When calculating GHGs from a project, if they are less than the established efficiency standard the project would not be significant relative to GHG emissions, while projects exceeding the efficiency standard would be significant.

Projects that cannot comply with any of the compliance options in Tier 4 would then move on to Tier 5.

- **Tier 5 –** consists generally of the Tier 3 compliance option 3 from the previous staff proposal. The only difference is that the project proponent would be required to provide offsets for the life of the project, which is defined as 30 years. If the project proponent is unable to obtain sufficient offsets, incorporate design features, or implement GHG reduction mitigation measures, then GHG emissions from the project would be considered significant.

WORKING GROUP MEETING #5 (AUGUST 27, 2008)

Subsequent to Working Group meeting #3, SCAQMD staff received feedback on the revised staff proposal #2. Issues and concerns raised by the stakeholders on the initial staff proposal were addressed at the third Working Group meeting and are summarized in the following bullet points.

- A recommendation was made to modify the target objective of Tier 5 to be consistent with the target objective of Tier 4 compliance option 1, that is require emissions to be offset 30 percent from BAU rather than offset down to the screening level.

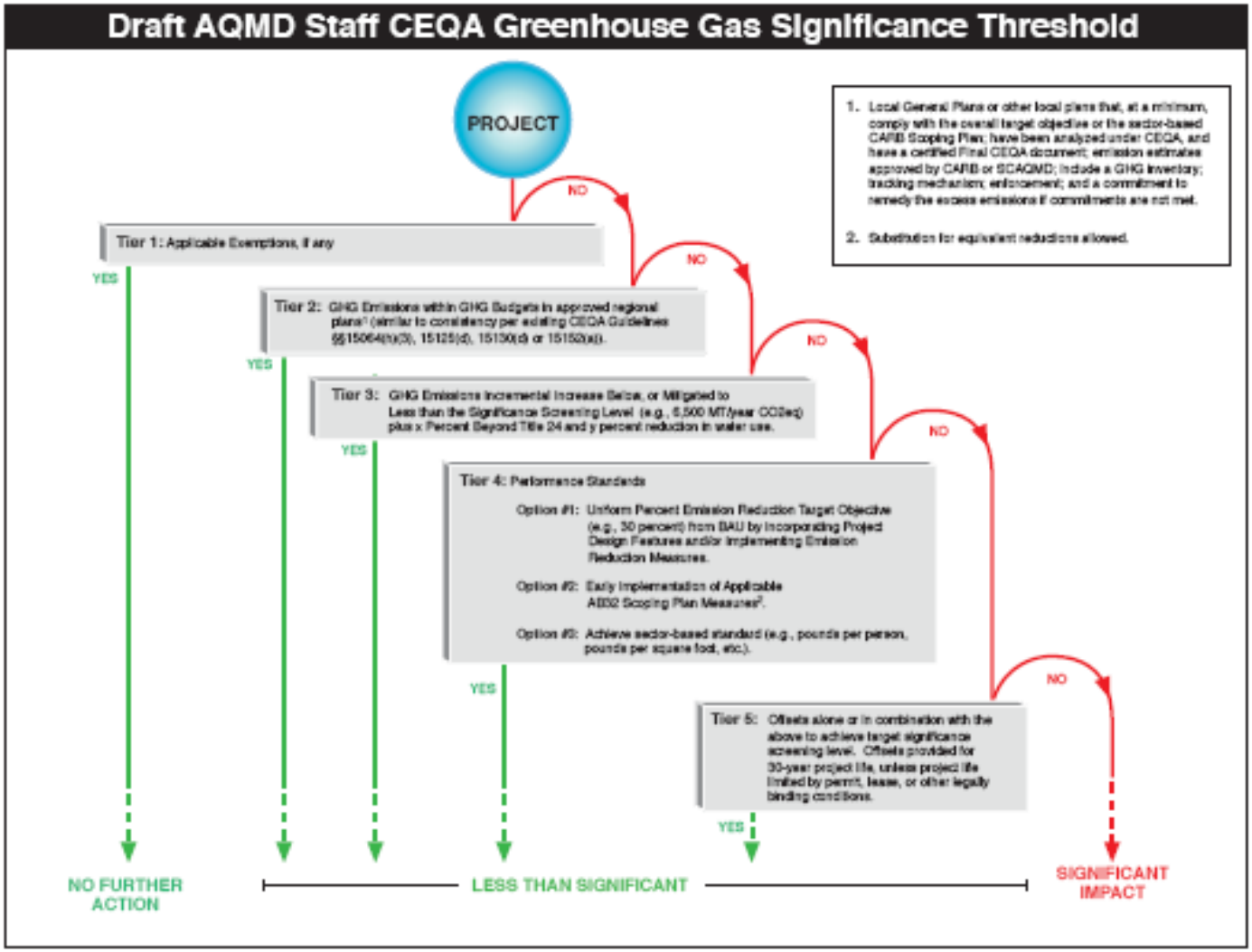
- A Working Group member asked for clarification on the early implementation of applicable AB 32 Scoping Plan measures in Tier 4-Option 2. In addition, a question was asked regarding whether or not this compliance option was applicable after the requirements of AB 32 have become effective.

At Working Group meeting #5, staff presented revised staff proposal #3, which consisted primarily of minor refinements to the previous tiered decision tree approach

in revised staff proposal #2. The components of revised staff proposal #3 are shown graphically in Figure B-4.

Aside from changing the graphic layout of the staff proposal to make it easier to understand, revised staff proposal #3 has only one minor modification. A second energy efficiency requirement has been added to the screening level in Tier 3. In addition to requiring projects to go a certain percentage beyond Title 24, projects would also have to reduce by a specified percentage electricity demand from water use, primarily electricity used for water conveyance.

Figure B-4
Revised Staff Proposal #3 Tiered Decision Tree Approach – August 27, 2008



HOW TO AVOID DANGEROUS CLIMATE CHANGE

A Target for U.S. Emissions Reductions





Union of Concerned Scientists
Citizens and Scientists for Environmental Solutions

HOW TO AVOID DANGEROUS CLIMATE CHANGE

A Target for U.S. Emissions Reductions

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September 2007

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The Union of Concerned Scientists is the leading science-based nonprofit working for a healthy environment and a safer world.

More information about the Union of Concerned Scientists is available on the UCS website at *www.ucsusa.org*.

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Executive Summary

Substantial scientific evidence indicates that an increase in the global average temperature of two to three degrees Celsius (°C) above pre-industrial levels (i.e., those that existed prior to 1860) poses severe risks to natural systems and human health and well-being. Sustained warming of this magnitude could, for example, result in such large-scale, irreversible changes as the extinction of many species and the destabilization and extensive melting of the Greenland and West Antarctic ice sheets—causing global sea level to rise between 12 and 40 feet. In light of this evidence, policy makers in the European Union have committed their countries to a robust long-term target of limiting warming to 2°C above pre-industrial levels.

The United States, under the United Nations Framework Convention on Climate Change, is committed to working with more than 180 other nations to bring about the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic [human-caused] interference with the climate system." There is also growing momentum within the United States to pursue deep reductions in emissions of carbon dioxide (CO_2) and other heat-trapping gases that cause global warming. California, Florida, Hawaii, Minnesota, New Jersey, Oregon, and Washington have all enacted laws or established policies setting global warming pollution reduction targets, while states in both the Northeast and West have signed agreements to achieve regional targets. Now the U.S. Congress is considering several bills that propose a variety of global warming emissions reduction targets.

This report provides an analytic basis for evaluating these bills and setting a sound long-term U.S. emissions reduction target consistent with avoiding dangerous climate change. Our analysis focuses on a goal of stabilizing the concentration, or level, of heat-trapping gases in the atmosphere at or below the CO_2 equivalent of 450 parts per million (450 ppm CO_2eq—a measurement that expresses the concentration of all heat-trapping gases in terms of CO_2).

Current science indicates that this stabilization target provides a medium chance (about 50 percent) of keeping the global average temperature from rising more than 2°C, or 3.6 degrees Fahrenheit (°F), above pre-industrial levels, and a 33 percent chance of rising more than 3°C. Therefore, **a 450 ppm CO_2eq stabilization target should represent the upper limit on concentrations of heat-trapping emissions set by any policy that seeks to avoid dangerous climate change**.

Given current levels of heat-trapping gases in the atmosphere, meeting this stabilization target will likely require atmospheric concentrations to peak above 450 ppm CO_2eq briefly before returning to the target. Recent studies indicate that, to follow such a path while still maintaining a reasonable chance of keeping temperatures from rising more than 2°C, cumulative *global* emissions must not exceed approximately 1,700 gigatons (Gt) CO_2eq for the period 2000–2050. Constraining cumulative global emissions (i.e., those of industrialized and developing nations) in this way will require reductions on the order of 40 to 50 percent below 2000 levels by 2050.

After accounting for the most aggressive reductions that can be reasonably expected of developing nations, the industrialized nations will have to reduce their emissions 70 to 80 percent below 2000 levels by 2050. Industrialized nations' cumulative emissions over this period must be no more than 700 GtCO_2eq (about 40 percent of the global budget).

This 70 to 80 percent range for reductions by 2050 assumes that industrialized nations' emissions

peak in 2010 and those from developing nations peak between 2020 and 2025. A delay in the peak of either group would require even faster reduction rates to stay within the global emissions budget.

This analysis explores several means of determining the United States' share of the industrialized nations' emissions budget, including allocations based on the current U.S. share (among industrialized countries) of population, gross domestic product (GDP), and heat-trapping emissions. Using these criteria, **the U.S. cumulative emissions budget is identified as 160 to 265 $GtCO_2eq$ for the period 2000–2050, of which approximately 45 $GtCO_2eq$ has already been emitted**.

Given our aggressive assumptions about reductions by other nations and the fact that 450 ppm CO_2eq represents an upper limit needed to avoid a potentially dangerous temperature increase, we argue that **the United States should reduce its emissions *at least* 80 percent below 2000 levels by 2050**.

The costs of delay are high. To meet this minimum target, the United States must reduce its emissions an average of 4 percent per year starting in 2010. If, however, U.S. emissions continue to increase until 2020—even on a "low-growth" path projected by the Energy Information Administration (EIA)—the U.S. reduction rate would have to accelerate to approximately 8 percent per year on average from 2020 to 2050. This amounts to a doubling of the annual reductions that would be required if we started promptly. By 2030, the cumulative emissions of the same EIA projection would nearly exceed the 265 $GtCO_2eq$ upper limit of the U.S. emissions budget for 2050.

Of the current climate policy proposals before the U.S. Congress, only the Global Warming Pollution Reduction Act (S. 309) and the Safe Climate Act (H.R. 1590) would require reductions consistent with staying below *the upper limit* of the U.S. cumulative emissions budget (265 $GtCO_2eq$). All of the other bills under consideration—the Lieberman-Warner proposal, the Global Warming Reduction Act (S. 485), the Climate Stewardship Act (H.R. 620), and the Low Carbon Economy Act (S. 1766)—would exceed that limit. The amounts by which these bills would go over the budget may not appear to be great, but if every nation went over its budget by a similar amount, the result would be a greatly increased risk of dangerous climate change.

Furthermore, no proposal currently before Congress would come close to meeting the proposed lower end of the U.S. emissions budget range (160 $GtCO_2eq$ for the period 2000–2050). Several of the proposals—S. 309, H.R. 1590, and the Global Warming Reduction Act (S. 485)—do provide for periodic review by the National Academy of Sciences to maintain or strengthen U.S. targets as needed to meet the goal of preventing a 2°C temperature increase—an essential element of any robust climate policy. Other proposals provide for review but fail to specify the 2°C goal or allow the targets to be strengthened if necessary.

As this analysis demonstrates, the United States must quickly overcome its current impasse on climate policy if we are to avoid the risks of dangerous climate change. Many solutions are already available, including greater energy efficiency, increased use of renewable energy, and reductions in deforestation. These changes can be encouraged by a wide range of market-based and complementary policies, such as cap-and-trade programs, renewable electricity standards, efficiency standards for electricity and vehicles, and incentives for cleaner technologies and international cooperation on emissions reductions.

The way forward is a fully engaged United States, committed both to deep reductions of its own heat-trapping emissions and supporting the efforts of developing countries that are attempting to reduce their emissions while sustaining economic growth.

I. Introduction

As a steady stream of new scientific findings highlights the growing risk of dangerous climate change, considerable momentum is building for the United States to set national policies that cap and reduce emissions of carbon dioxide (CO_2) and other heat-trapping gases. Policy makers weighing the available options for an effective climate policy must grapple with the following fundamental question:

> *To avoid dangerous climate change, what should be the long-term U.S. target for reducing emissions?*

Remarkably, no rigorous assessment exists that can answer this question for policy makers. In the absence of such an assessment, current climate policy proposals before the U.S. Congress set widely divergent national emissions targets (see the appendix). A coalition of U.S. businesses including Alcoa, Caterpillar, DuPont, and General Electric, working with environmental groups as part of the U.S. Climate Action Partnership, recently called on Congress to "specify an emission target zone aimed at reducing emissions by 60%-80% from current levels by 2050."

In addition, several states are setting their own reduction targets and policies. California has set a goal of reducing its emissions 80 percent below 1990 levels by 2050, while New Jersey has set a state target of 80 percent below 2006 levels by 2050.[1] Both states have also passed legislation putting the first phase of their plans (reducing emissions to 1990 levels by 2020) into law. Minnesota has set into law an emissions reduction target of 80 percent below 2005 levels by 2050. In Florida, Governor Crist has signed an executive order requiring electric utilities to reduce emissions 80 percent below 1990 levels by 2050.

Achieving the deep reductions envisioned in these policies and proposals will require a concerted effort to move away from our current national pathway of increasing emissions. Absent such an effort, U.S. energy-related emissions of CO_2 are projected to grow 20 to 45 percent between 2007 and 2030 (EIA 2007).

This paper draws upon the best available science to provide a rationale for a sound long-term U.S. emissions reduction target. We focus on a goal of stabilizing the concentration, or level, of heat-trapping gases in the atmosphere at or below the CO_2 equivalent of 450 parts per million (450 ppm CO_2eq).[2] Stabilizing at this level would provide a medium chance (about 50 percent) of avoiding the increasingly dangerous consequences expected if the global average temperature were allowed to rise more than two degrees Celsius (°C), or 3.6 degrees Fahrenheit (°F), above pre-industrial levels (i.e., levels prior to 1860; see Figure 1, p.4, and Box 1, p.6).

We next identify a global emissions budget consistent with this concentration limit, and determine a practical share of this budget for the United States and the rest of the industrialized world (based on an assessment of various aggressive emissions reduction scenarios for developing nations). We used 2050 as our target date for U.S. reductions because this has been the most commonly used long-term reference period in climate policy proposals to date.

Finally, we assess how current climate policy proposals for U.S. emissions reductions compare with the targets presented in this analysis.

Figure 1a. Probability of Exceeding 2°C Increase in Global Average Temperature

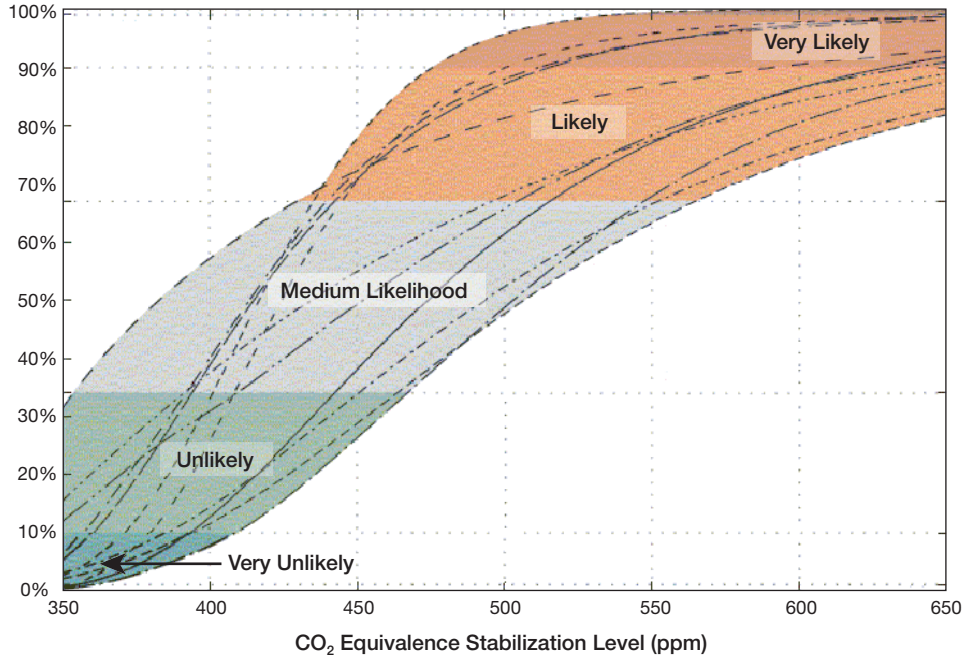
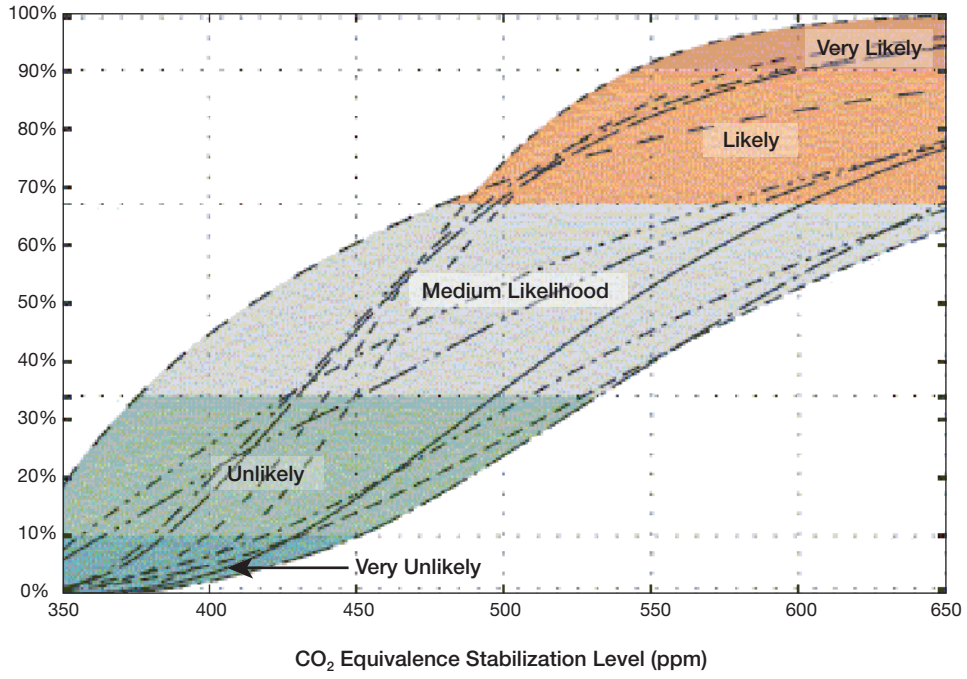


Figure 1b. Probability of Exceeding 3°C Increase in Global Average Temperature



The probability of exceeding a 2°C and 3°C increase in global average temperature at different CO_2-equivalent stabilization levels. The dashed lines represent different published estimates of climate sensitivity (here defined as the amount global average temperatures are expected to rise as a result of a doubling in atmospheric concentrations of CO_2). Source: modified from Meinshausen (2006) and Meinshausen et al. (2006).

II. Setting a Global Limit on Heat-trapping Emissions

The ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC), as stated in Article 2, is "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic [human-caused] interference with the climate system" (UNFCCC 1992). This is the long-term climate policy commitment agreed to by more than 180 nations including the United States.

However, because "dangerous anthropogenic interference" is not well defined under the UNFCCC (Oppenheimer and Petsonk 2005), policies to prevent dangerous change may differ in the criteria used to define "dangerous." These criteria can be informed by scientific assessments of the risks associated with rising emissions and temperatures, but they are ultimately determined by societal values regarding what risks are unacceptable (and therefore "dangerous"). By some measures, current atmospheric levels of heat-trapping gases may already be causing dangerous climate change (e.g., Poumadere et al. 2005).

Policy makers in the European Union have weighed the risks identified by scientific research and committed their countries to a long-term target limiting warming to 2°C above pre-industrial levels (European Council 1996, 2005), a target recently reaffirmed by the International Climate Change Taskforce (ICCT 2005). As new scientific information points to potentially dangerous consequences if the global average temperature increases more than 2°C above pre-industrial levels (Box 1, p.6), this target remains a robust policy goal.

Establishing a temperature target, however, does not answer the question: what limit on atmospheric concentrations of heat-trapping gases will constrain warming from rising more than 2°C above pre-industrial levels? It is not currently possible to predict precisely how much the global average temperature will rise with increasing atmospheric concentrations of heat-trapping gases. There are a number of natural "feedback" mechanisms built into the climate system that can amplify or dampen warming trends, and many of these are not yet fully understood. The likely range of climate sensitivity (how much the global average temperature will rise in response to a given increase in atmospheric CO_2 levels) is 2°C to 4.5°C (3.6°F to 8.1°F) for a doubling (from pre-industrial levels) of CO_2 concentrations in the atmosphere (Meehl et al. 2007). However, scientific assessments conclude that it is still possible that climate sensitivity could be greater than 4.5°C (e.g., Meehl et al. 2007; Hegerl et al. 2006; Stainforth et al. 2005).

The uncertainty regarding climate sensitivity requires the selection of an appropriate atmospheric concentration limit based on a risk perspective (i.e., the desired level of certainty for keeping temperature increases below 2°C). Figure 1a depicts the chances of exceeding a temperature threshold of 2°C at different stabilization levels and Figure 1b depicts the chances of exceeding 3°C.

If atmospheric concentrations of heat-trapping gases are stabilized at 400 ppm CO_2eq, it is unlikely (less than a one-third chance) that the long-term global average temperature increase will exceed 2°C. At 450 ppm CO_2eq, there is a medium likelihood of exceeding 2°C (approximately a 50-50 chance), but it is unlikely that warming will exceed 3°C (less than a one-third chance). However, if concentrations stabilize at 500 ppm CO_2eq, it is likely (greater than a two-thirds chance) that warming will exceed 2°C, and there is at least a

(*continued on p.8*)

Box 1. What Happens If Temperatures Increase More Than 2°C?

A growing body of scientific evidence links global average temperature increases of greater than 2°C above pre-industrial levels (i.e., prior to 1860) with a number of potentially severe climate impacts on social and natural systems (Parry et al. 2007a; Hansen et al. 2006) (Figure 2). The magnitude of many of these impacts and the risk of irreversible impacts grows with increasing temperature.

For example, ice sheets in Greenland and West Antarctica store vast quantities of frozen water that, if melted, would cause the global sea level to rise by meters. While these ice sheets may still be adding ice and snow in their cold, dry interiors, their edges and surfaces are beginning to melt more rapidly and extensively. Sustained warming between 1.6°C and 5.2°C could initiate widespread destabilization of these ice sheets (Meehl et al. 2007; Alley et al. 2006; Gregory and Huybrechts 2006; Overpeck et al. 2006), leading to sea level rise of two to seven meters (6.6 to 23 feet) from Greenland melting and 1.5 to 5 meters (5 to 16.4 feet) from West Antarctica melting. While the full rise in sea level may take centuries to occur, even one meter (three feet) of sea level rise would significantly change global coastlines, threatening major cities including Mumbai, New York, and Tokyo, and inundating some small islands.

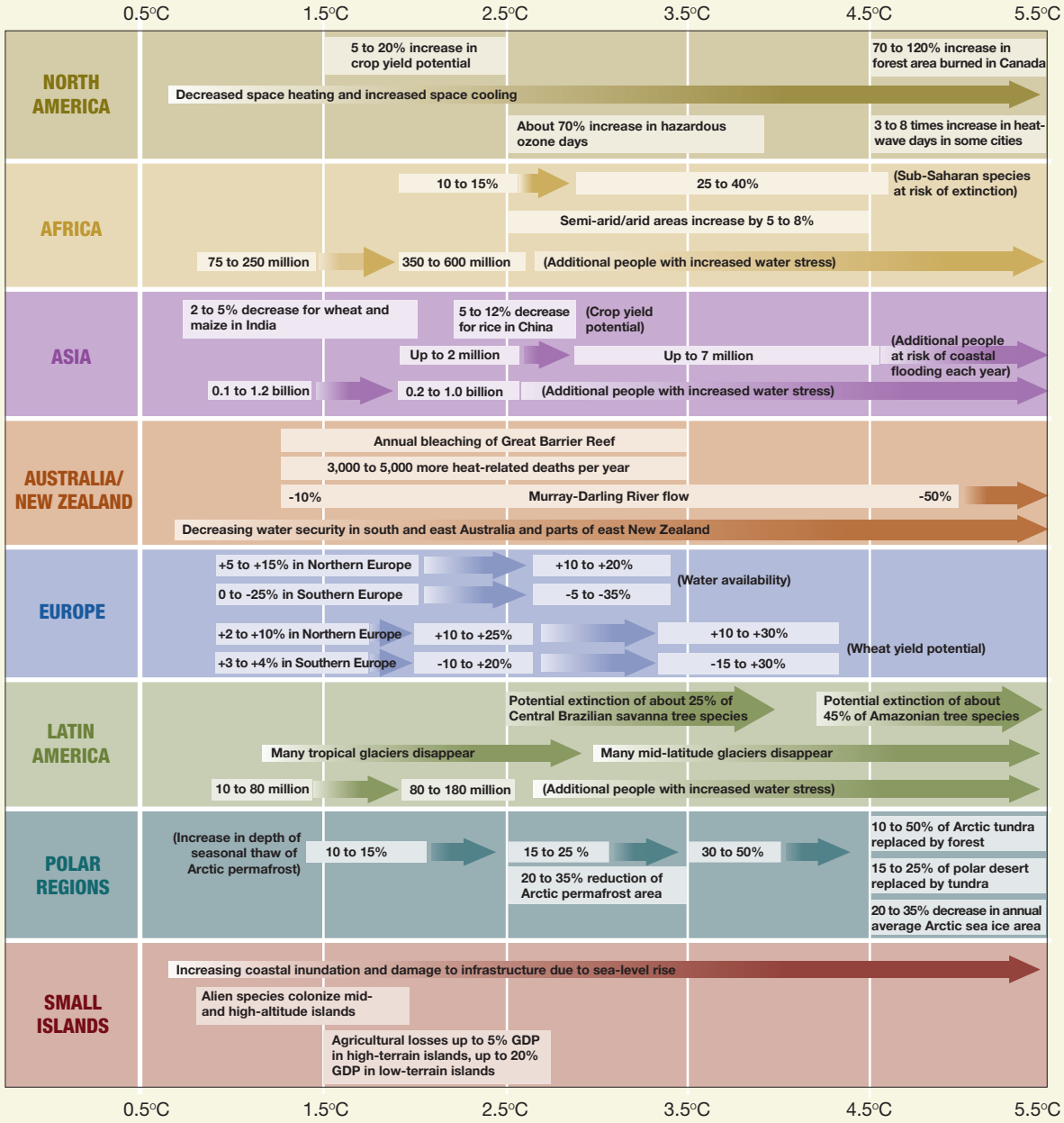
A 2°C to 3°C level of warming has been linked to species extinctions and sweeping changes in world ecosystems. In this temperature range, the Intergovernmental Panel on Climate Change (IPCC) has estimated that approximately 20 to 30 percent of species could risk extinction (Fischlin et al. 2007). Some parts of the biosphere may switch from a carbon sink (which absorbs more CO_2 than it emits) to a carbon source (which emits more CO_2 than it absorbs), further increasing atmospheric levels of CO_2 and exacerbating the warming caused by human activities (Scholze et al. 2006). This level of temperature increase is also above the thresholds at which many coral reefs would become bleached (McWilliams et al. 2005; O'Neill and Oppenheimer 2002). In addition, increasing atmospheric CO_2 concentrations lead to increasing ocean acidification, with potentially significant impacts on marine ecosystems.

Warming in this range has also been linked to increases in the severity of many climate impacts—some of which are already intensifying—including floods, droughts, heat waves, fires, the spread of infectious diseases, and heat-related deaths (Rosenzweig et al. 2007). For example, 1 to 2 billion people would be at risk of increased water scarcity (IPCC 2007a).

In the continental United States specifically, drought-prone ecosystems are projected to expand approximately 11 percent in area for each degree Celsius of additional warming (Field et al. 2007). Water resources in California would be highly threatened, as the Sierra Nevada snowpack is projected to decrease 60 percent from the 1961–1990 historical average under the drier conditions associated with a 2.4°C increase in global average temperature (CCCC 2006; Hayhoe et al. 2004). That same temperature increase would cause many cities across the northeastern United States to experience a projected tripling in the number of days featuring extreme summer heat (high temperatures above 32°C or 90°F), increasing the risk of heat-related illness and death among vulnerable populations (Frumhoff et al. 2007).

Rising sea levels will threaten U.S. coastal communities and ecosystems by increasing the impact of storms on coastal areas (Field et al. 2007). A 2.4°C increase in global average temperature, for example, would result in a conservatively projected 7- to 14-inch rise in sea level, causing Boston and Atlantic City, NJ, to experience coastal flooding equivalent to today's 100-year flood almost every year on average (Frumhoff et al. 2007).

Figure 2. Regional Climate Impacts Worsen as Temperature Increases



Examples of the projected consequences associated with different increases in global average surface temperature above pre-industrial levels. Placement of text boxes indicates the range of temperature change in which the consequences would occur; arrows indicate increasing intensity of the consequences as temperature rises. Adaptation measures are not included in these estimations. Source: modified from Parry et al. (2007b).

medium likelihood (approximately a 50-50 chance) that the global average temperature will rise more than 3°C above pre-industrial levels.

Given these probabilities and the growing evidence that the risk of dangerous impacts increases if Earth warms more than 2°C above pre-industrial levels (Box 1, p.6), society should view a 450 ppm CO_2eq stabilization target as the upper limit for a policy that will satisfy any reasonable definition of "dangerous" climate change. We have therefore focused this analysis on U.S. emissions reductions needed to stabilize heat-trapping gases at or below this level.

III. Different Pathways to the Stabilization Target

Atmospheric concentrations of CO_2 have risen from approximately 280 ppm at the outset of the Industrial Revolution to more than 385 ppm today. Concentrations of other heat-trapping gases have also increased, but recent studies indicate that their current influence on rising temperatures may be roughly offset by the cooling effect of reflective sulfate aerosols and other fine particulate matter that enter the atmosphere both from the burning of fossil fuels and natural sources such as volcanic eruptions (Meehl et al. 2007). Because aerosols stay in the atmosphere for a short period of time (on the order of 10 days, versus about 100 years for a molecule of CO_2), reductions in fossil fuel use and improvements in air quality are expected to diminish their net cooling effect (Meehl et al. 2007). Absent this effect of aerosols, today's atmospheric concentrations of heat-trapping gases would be approximately 450 ppm CO_2eq already—and rising 2.7 ppm per year (Hoffman et al. 2006).

Given these already high (and increasing) levels, stabilizing concentrations at or below 450 ppm CO_2eq is likely to be feasible only if we allow concentrations to initially rise above the target before returning to it later (by reducing emissions from human activities to levels below the rate at which heat-trapping gases are captured through natural processes such as photosynthesis). Fortunately, inertia inherent in the climate system's response to increasing emissions, which is largely the result of the oceans' capacity for storing a massive amount of heat, causes temperature increases to lag several decades behind increases in concentrations of heat-trapping gases.

Therefore, it is possible for concentrations to exceed the final stabilization goal, peak, then decline back to the targeted level without the full temperature increase that would correspond to sustained concentrations at the peak—provided the peak is sufficiently modest and brief. For example, Meinshausen et al. (2006) report that peaking at 500 ppm CO_2eq by 2050 (which would still require significant emissions reductions) and slowly returning to 450 ppm CO_2eq by maintaining emissions below the rates of natural uptake would provide a medium chance of avoiding a 2°C increase.[3]

Several studies suggest that to stabilize between 400 and 450 ppm CO_2eq with a higher peak, the global cumulative emissions budget must be on the order of 1,700 gigatons (Gt) CO_2eq for the

period 2000–2050 (van Vuuren et al. 2007; Baer and Mastrandrea 2006; Meinshausen et al. 2006).[4] To stay within this budget, global emissions would have to be reduced on the order of 40 to 50 percent below 2000 levels by 2050 (den Elzen and Meinshausen 2006).[5]

The analysis here is based on a 450 ppm CO_2eq multi-gas global emissions pathway proposed by Meinshausen et al. (2006),[6] with a cumulative budget for the period 2000–2050 of 1,690 GtCO_2eq.[7] This pathway leads to atmospheric concentrations peaking at 500 ppm CO_2eq around mid-century, with concentrations stabilizing at (and potentially below) 450 ppm CO_2eq through continued reductions in CO_2 emissions from human activities after 2050.[8]

To maintain worldwide economic growth while staying within the required emissions budget, the global economy must undergo a profound technological transformation and substantially reduce its emissions from fossil fuels. The global economy is already moving in the direction of less carbon-intensive growth (Nakicenovic 2000), but because there is an absolute limit on the cumulative volume of heat-trapping gases that can be emitted before exceeding the proposed 450 ppm CO_2eq stabilization limit, a far more rapid shift away from fossil fuels will be necessary in the coming years (IPCC 2007b).[9]

The phaseout of energy-related emissions must proceed rapidly to mid-century, and continue more gradually throughout the second half of the century. This initially rapid decrease is essential if we are to minimize the size and timing of the peak in atmospheric concentrations above 450 ppm CO_2eq.

IV. Complementary Targets for Industrialized and Developing Nations

Given a global emissions budget (the overall amount of carbon that can be released into the atmosphere worldwide), the next task is to allocate each nation's share of responsibility for the budget—first, by dividing the budget between industrialized and developing nations as a whole, and then, among individual nations. Several proposals suggest that the most equitable approach would be to allocate global emissions reductions by population (e.g., Meyer 2000). Others have suggested that emissions allocation should be based on relative capacity for emissions reductions (Athanasiou et al. 2006), relative gross domestic product (GDP) (Vattenfall 2006), current carbon intensity (the level of emissions compared with GDP) (Herzog et al. 2006; Pizer 2005), historic emissions levels (otherwise known as "grandfathering," as was done in the U.S. acid rain program) (Burtraw et al. 2005), historical responsibility for emissions (the so-called Brazilian Proposal) (UNFCCC 1997), or a subset of these criteria (CAN 2003).

This is a discussion that could clearly continue for some time. Unfortunately, the world no longer has the luxury of engaging in a persistent stalemate. The risks of the temperature increase discussed above and the scale of emissions reductions needed to avoid those risks clearly show that the United States and other signatories to the UNFCCC must rapidly establish a consensus on the equitable and effective allocation of emissions among nations.

In the absence of such a consensus, and for the purposes of this analysis, we submit that any practical allocation strategy must accept the following realities:

- Avoiding the potentially dangerous consequences of a 2°C increase in the global average temperature will require an absolute limit on total cumulative heat-trapping emissions over the coming decades (a "cumulative emissions budget").
- Staying within this cumulative emissions budget will require a global economic transition away from fossil fuel-intensive growth by mid-century, as well as significant reductions in emissions from deforestation, particularly in tropical countries (Gullison et al. 2007).
- To accomplish this transformation, industrialized nations must lead the world in developing the necessary clean energy technologies and infrastructure and creating more effective mechanisms for disseminating that technology and capacity to developing nations. These mechanisms should encourage communication in both directions, since some developing countries are also making significant contributions to the development of clean energy technologies (as well as reductions in deforestation).
- Timing is critical—industrialized nations need to transform their economies over the next few decades and partner with developing nations to ensure that these countries' economic growth follows a much cleaner path than the one the industrialized world took to get where it is today.

Given these realities, a *practical* emissions reduction strategy must be one in which the total cumulative emissions of industrialized nations are sufficiently constrained between now and 2050 so that the remaining global emissions budget can be achieved with aggressive but realistic expectations about emissions reductions in developing nations. This paper makes no assumptions about specific policies for tackling climate change or which countries would be likely to implement or pay for such policies. But it is clear that the United States and other industrialized nations must not only transform their own economies but also help facilitate emissions reductions in developing countries. This can be done through a combination of expansion of carbon market mechanisms, technology transfer, direct financial assistance, and other means. In fact, the sooner industrialized countries can dramatically expand such activities, the sooner developing countries will be able to reduce their emissions.

For the purposes of this analysis, we define "aggressive but realistic expectations" about developing nations' emissions reductions in the following terms:

- Developing nations' average annual emissions peak between 2020 and 2025—10 to 15 years after those of industrialized nations. This time lag accounts for industrialized nations' historically far greater contribution to global emissions; it is also consistent with the principle of "common but differentiated responsibilities" embodied in the UNFCCC. A lag of more than 10 to 15 years would require increasingly steep and unrealistic global reduction rates.
- During this 10- to 15-year period, developing nations' average annual emissions continue to increase at a relatively slow rate, following a "low-growth" emissions trajectory defined by the Energy Information Administration (EIA 2007).[10] Such a trajectory can be facilitated by the mechanisms described above.
- Once developing nations' emissions peak, their average annual reduction rates match those of industrialized countries.

In order to divide the global emissions budget of 1,690 $GtCO_2eq$ for the period 2000–2050 between industrialized and developing nations according to the above criteria, the industrialized nations must reduce their emissions an average of 70 to 80 percent below 2000 levels by 2050 (Table 1, p.11). The share of the budget for all industrialized nations must fall between 600 and 700 $GtCO_2eq$ for that period.

The 70 to 80 percent range for emissions reductions by 2050 assumes that industrialized nations' emissions peak in 2010 and those from developing nations peak between 2020 and 2025. Delays in these peaks would require increasingly unrealistic reduction rates in global emissions to remain within the global budget (Table 1).

Given these aggressive assumptions, the United States' high per capita emissions relative to the industrialized country average (about double), and the fact that 450 ppm CO_2eq represents an upper limit needed to avoid a potentially dangerous temperature increase, we argue that the United States should aim to reduce its emissions *at least* 80 percent below 2000 levels by 2050.[11]

Figure 3a (p.12) displays emissions pathways that assume industrialized nations' emissions peak in 2010 and developing nations' emissions peak in 2020 (allowing a cumulative emissions budget of 700 GtCO_2eq for industrialized nations).[12] In this case, the average developing nation would be required to reduce its emissions on the order of 25 percent below 2000 levels by 2050. China, however, would likely have to reduce its emissions at a significantly higher rate since it currently accounts for about one-third of the developing world's emissions from energy use (EIA 2007).

The current disparity in per capita emissions between industrialized and developing countries is reduced under this scenario, but not eliminated by 2050 (Figure 3b, p.12). Although this analysis does not consider scenarios beyond 2050, an equitable solution beyond this date would be to move toward equal per capita emissions for all countries.

The annual rate of reduction needed to achieve the 2050 targets will depend on when developing nations' emissions peak. If, for example, their total emissions peak by 2020 according to the above criteria, then the average reduction rate required by both developing and industrialized nations will be approximately 3.5 percent per year. However, if developing nations' emissions peak in 2025, then the required global average reduction rate would be nearly 5 percent per year.

Given the daunting challenge of such rapid rates (den Elzen et al. 2006)—especially in light of the fundamental development needs of growing populations—this analysis suggests that meeting the 450 ppm CO_2eq stabilization target would be greatly facilitated if emissions from rapidly industrializing nations such as China and India peak no later than 2020. The rapid economic growth projected for these countries over this time frame means that a 2020 peak will require significant reductions in the carbon intensity of their economies.

While not fully addressed in this analysis, aggressive near-term reductions in deforestation rates in key forest-rich developing countries such as Brazil and Indonesia can be a significant complement to reductions in energy-related emissions and increase the prospects for stabilization at or below 450 ppm CO_2eq (Gullison et al. 2007).

Table 1. Emissions Reductions Required in Industrialized Nations by 2050

Emissions Peak (Developing Nations)	Emissions Peak (Industrialized Nations) 2010	2020
2020	70%	80%
2025	80%	90%
2030	90%	95%

The differing average percentage reductions (below 2000 levels) needed to achieve a 450 ppm CO_2eq stabilization target, depending on when emissions peak for both industrialized and developing nations. For total cumulative emissions not to exceed the global budget, the reduction requirements of developing and industrialized nations must be interdependent. This analysis assumes that once emissions have peaked for both industrialized and developing nations, the two groups will have equal average annual reduction rates.

Figure 3a. Emissions Reduction Pathways

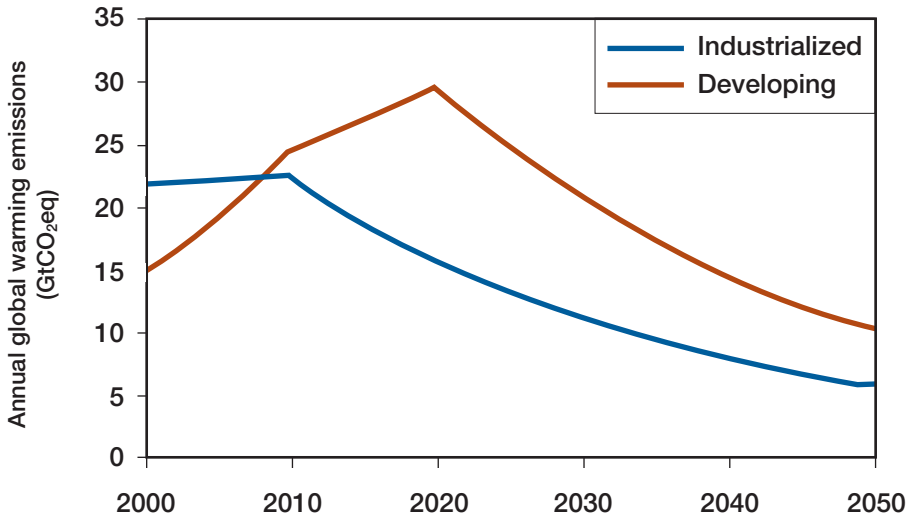


Figure 3b. Emissions Reduction Pathways (Per Capita)

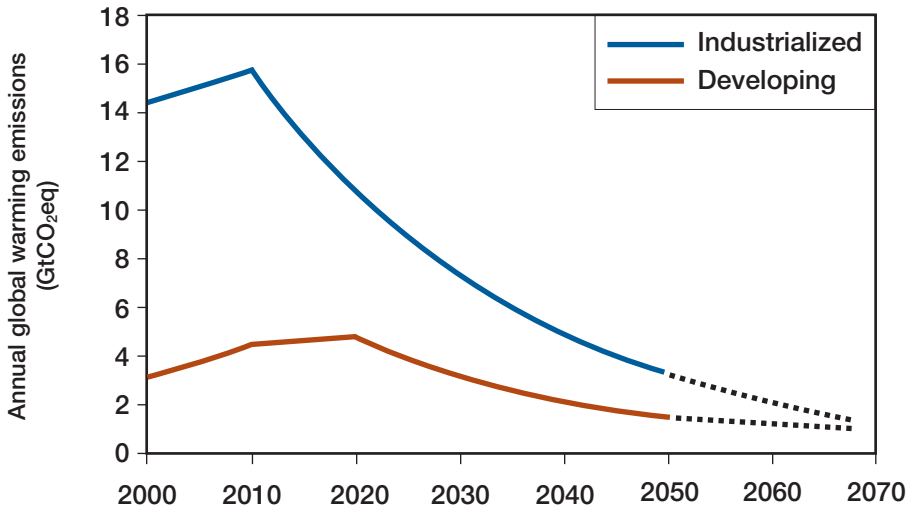


Figure 3a depicts emissions pathways for industrialized and developing nations that satisfy a cumulative emissions budget for the period 2000–2050 consistent with a 450 ppm CO_2eq stabilization target. Industrialized nations' emissions of the three key heat-trapping gases (CO_2, methane, nitrous oxide) peak in 2010 while developing nations' emissions peak in 2025, allowing an emissions budget of 700 $GtCO_2$eq for industrialized nations as described in the text. Pre-peak emissions represent the EIA Low Projection for energy-sector emissions (EIA 2007). Figure 3b depicts the same emissions pathways from a per capita perspective. Although this analysis does not consider scenarios beyond 2050, an equitable solution beyond this date would be to move toward equal per capita emissions, as illustrated here.

V. The U.S. Share of the Global Emissions Budget

Having allocated the cumulative emissions budget for the period 2000–2050 among industrialized and developing nations, we now ask what share of the industrialized nations' budget should the United States assume? This will determine how quickly U.S. emissions must be reduced, and what pathway our reductions should follow. There are a number of ways the U.S. allocation could be determined; we explored three alternative methods based on the United States' current share of (a) population, (b) GDP, and (c) heat-trapping emissions (in CO_2eq terms) among all industrialized nations.

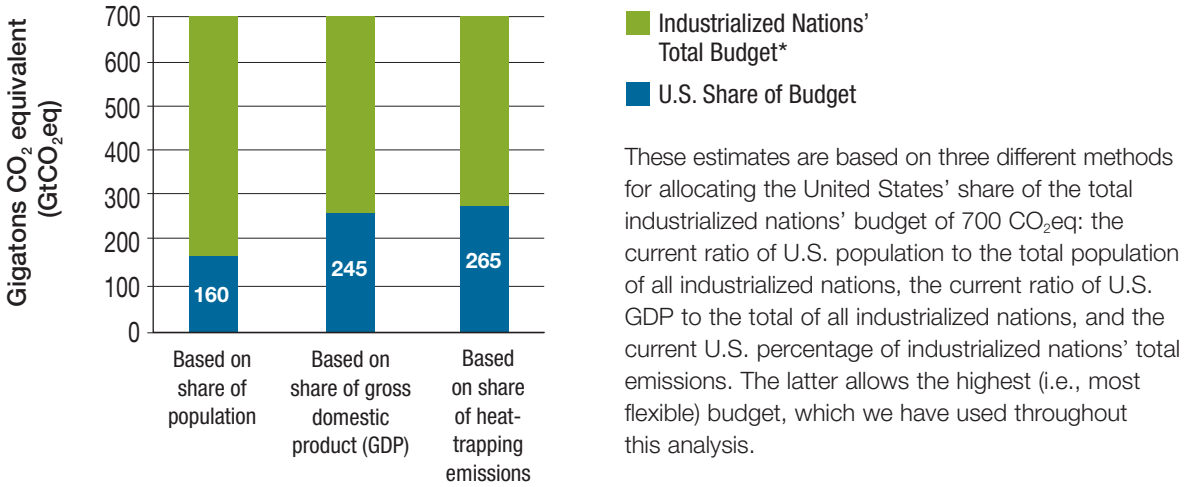
According to the above criteria, the U.S. cumulative emissions budget for the period 2000–2050 ranges from 160 to 265 $GtCO_2$eq (Figure 4), assuming that industrialized nations' emissions peak in 2010 and developing nations' emissions peak between 2020 and 2025. Allocation based on current population would require the lowest (or most strict) U.S. budget: 23 percent of the industrialized nations' total, or 160 $GtCO_2$eq. Allocation by current GDP would require 35 percent of the total, and allocation by current heat-trapping emissions would allow the highest (or most flexible) budget: 38 percent of the total, or 265 $GtCO_2$eq.

In summary, a U.S. reduction strategy consistent with stabilizing atmospheric concentrations at or below the 450 ppm CO_2eq target must:

1) **Reduce emissions at least 80 percent below 2000 levels by 2050**. This is equivalent to reductions of at least 78 percent below 1990 levels or at least 82 percent below current (2007) levels.

2) **Constrain cumulative emissions between 160 and 265 $GtCO_2$eq for the period 2000–2050**—of which approximately 45 $GtCO_2$eq had already been emitted by the end of 2005.[13]

Figure 4. Defining the U.S. Cumulative Emissions Budget for the Period 2000–2050



These estimates are based on three different methods for allocating the United States' share of the total industrialized nations' budget of 700 CO_2eq: the current ratio of U.S. population to the total population of all industrialized nations, the current ratio of U.S. GDP to the total of all industrialized nations, and the current U.S. percentage of industrialized nations' total emissions. The latter allows the highest (i.e., most flexible) budget, which we have used throughout this analysis.

*All heat-trapping emissions including those from land use and land cover changes. The budget assumes industrialized nations' emissions peak in 2010 and developing nations' emissions peak in 2020.

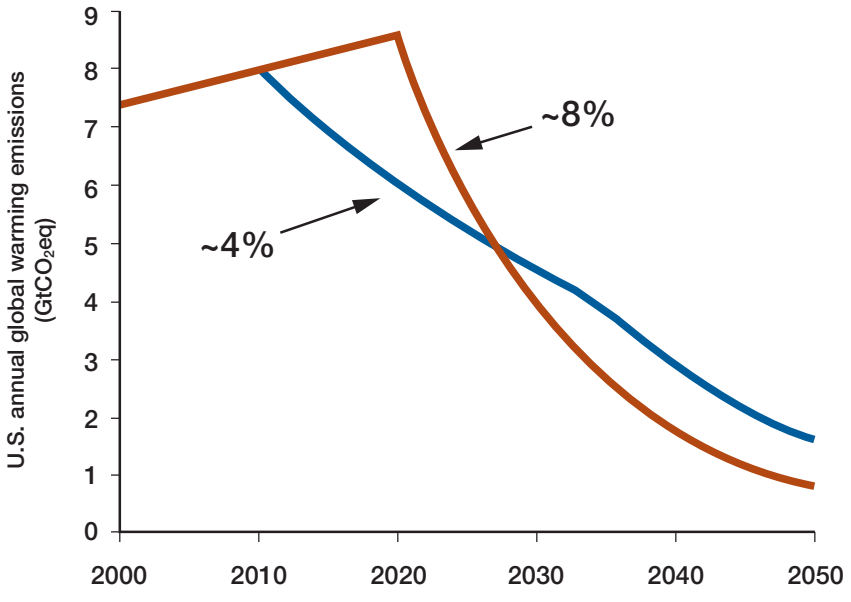
VI. What We Need to Do

What then is a reasonable emissions pathway that would stay within the given U.S. emissions budget? It is clear that a continued increase in emissions in the near term would require dramatically greater reductions over a shorter time frame later. Furthermore, these rapid later reductions would likely be more difficult and expensive to achieve than gradual changes over a longer period of time.

For example, to achieve the minimum 80 percent reductions below 2000 levels by 2050, the United States must reduce its emissions an average of 4 percent per year starting in 2010. However, if U.S. emissions continue to increase up until 2020 as projected by the EIA Low Projection (EIA 2007), the annual average rate of reduction would have to be raised to approximately 8 percent per year from 2020 to 2050. This amounts to about double the annual reductions required by an "early start" plan (Figure 5). Furthermore, if the United States follows the EIA Low Projection path, it will exceed the 160 $GtCO_2$ budget by 2020, and nearly exceed the 265 $GtCO_2$ budget by 2030.

In other words, an "early start" plan that requires reductions to begin in 2010 could reduce average reduction rates to less than half what would be required with a 2020 start. This does not imply, however, that there is only one possible pathway to meet the U.S. reduction target. Several examples are discussed in Box 2.

Figure 5. Implications of Delay



Reductions in U.S. annual emissions that would be required based on a start date of 2010 (blue line) or 2020 (red line). This analysis assumes that U.S. emissions would follow the EIA Low Projection (EIA 2007) until emissions reductions begin. Initiating reductions in 2010 would require a 4 percent reduction rate through 2050 to stay within a cumulative emissions budget of 265 $GtCO_2eq$ (consistent with a 450 ppm CO_2eq stabilization target). Delaying reductions until 2020, however, would not only require a faster reduction rate (at least 8 percent) to stay within the same budget, but deeper reductions as well. (The areas under each curve have been constrained so that cumulative emissions do not exceed 265 $GtCO_2eq$.) Note that to stay within a 160 $GtCO_2eq$ emissions budget would require even steeper reduction rates.

Box 2. Other Ways to Hit the Target

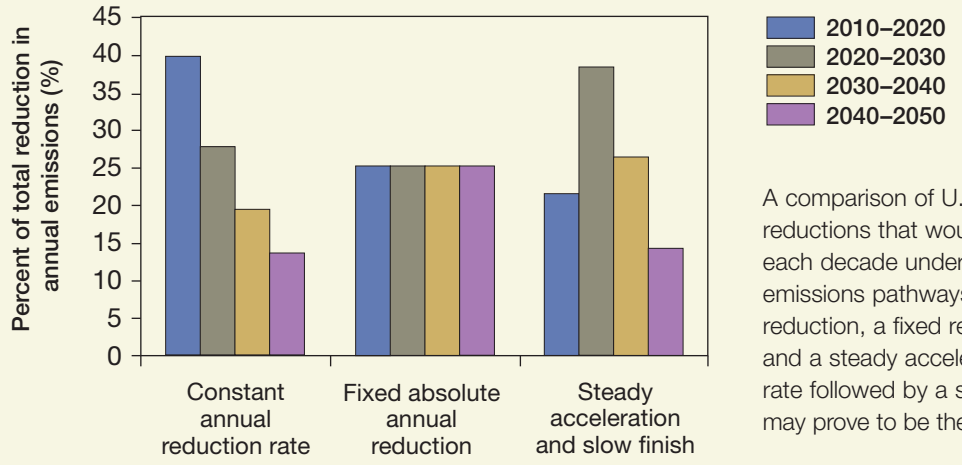
Both globally and at the national level, there are a number of possible pathways that would succeed in achieving the emissions reduction target and staying within the cumulative emissions budget discussed here. For example, if U.S. reductions begin in 2010, the minimum target of 80 percent below 2000 levels by 2050 could be achieved by a constant annual reduction of either 4 percent per year or 0.16 $GtCO_2eq$ per year in absolute terms, which is equivalent to 2 percent of 2007 levels (Figure 6). Alternatively, the United States could pursue a steady increase in reduction rates, beginning at 3 percent per year in the first two decades and rising to 5 percent per year in the final two decades (Frumhoff et al. 2007; Moomaw and Johnston 2007).

While these approaches may be appealing for their apparent simplicity, they are not necessarily optimal pathways. For example, it might be preferable for the United States to complement a steadily accelerating reduction rate with absolute reductions that peak and then decline (Figure 6). This would allow initial emissions reduction efforts to focus on energy efficiency, renewable energy, and advanced vehicle technologies—solutions that are already within our reach and have considerable near-term potential (IPCC 2007c).

Over time, it may be possible to deploy additional technologies, such as carbon capture and storage, that will require significant investments in research and development before deployment at a significant scale becomes both feasible and effective. Finally, it might be reasonable to anticipate lower absolute reductions toward the end of the budget period, as these final reductions could be the hardest to achieve.

An effective emissions reduction strategy should also include sufficient shorter-term benchmarks, or interim targets, to ensure that the current pathway will not exceed the cumulative budget and that the country is making effective progress toward low-emissions growth. These interim targets would also send an important market signal to businesses and investors who will be making decisions about long-life capital investments. Such targets are an important feature of existing state policies and key federal legislative proposals.

Figure 6. Timing of U.S. Emissions Reductions under Alternate Pathways



A comparison of U.S. emissions reductions that would be required in each decade under three different emissions pathways: a constant rate of reduction, a fixed reduction percentage, and a steady acceleration of reduction rate followed by a slower rate. The latter may prove to be the most feasible option.

VII. Would Any Existing Proposals Get the Job Done?

The standard we have recommended can be used to judge the adequacy of existing climate policy proposals (in terms of whether the emissions reductions would be sufficient to prevent atmospheric concentrations of heat-trapping gases from rising above the level at which the risks of dangerous climate change are unacceptably high). A number of bills currently being considered would set both short- and long-term U.S. emissions reduction targets (see the appendix). Figure 7 compares the emissions pathways of these proposals with that of the target proposed in this analysis. Figure 7a compares emissions over the period 2000–2050 with the EIA Low Projection (EIA 2007)[14] and pathways consistent with staying within the cumulative U.S. emissions budget range of 160 to 265 $GtCO_2eq$.

Figure 7b compares cumulative emissions for the period 2000–2050 under each of the proposals. Only H.R. 1590 (Waxman) and S. 309 (Sanders-Boxer) require reductions consistent with staying within the 265 $GtCO_2eq$ budget this analysis identifies as the least the United States should do to meet the 450 ppm CO_2eq stabilization target. For S. 1766 (Bingaman-Specter), a range of potential cumulative emissions is presented that illustrates the implications of reaching the price ceiling outlined in the bill. If that price ceiling is exceeded, emissions reductions would slow and the reduction targets established in the bill would not be met. The color gradient in the upper portion of the bar represents the uncertainty in total cumulative emissions if the bill's price ceiling were triggered; the total could approach the cumulative emissions projected under a low-growth "business as usual" scenario (EIA 2007).

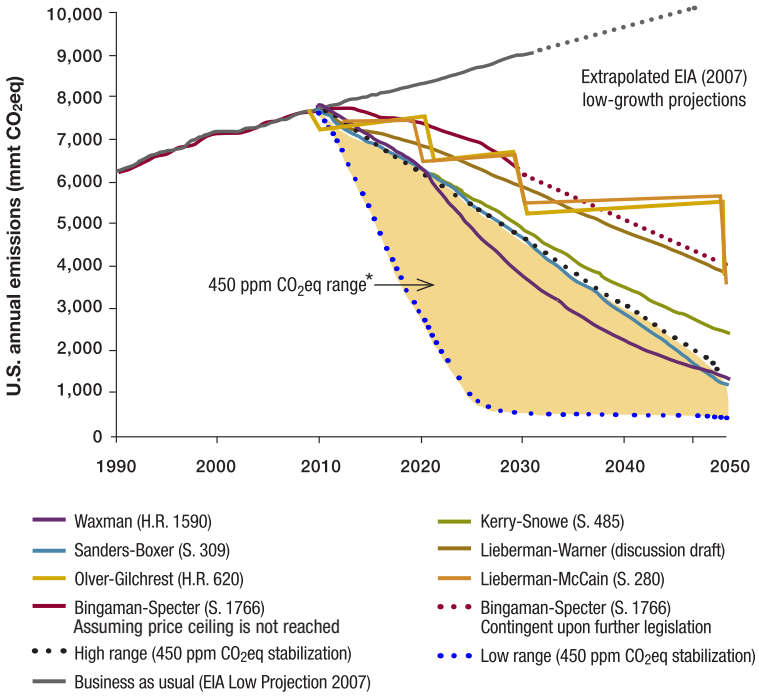
While the amounts by which S. 485 (Kerry-Snowe), the Lieberman-Warner proposal, and S. 1766 exceed the emissions budget may not appear to be great, if every nation of the world overshot its budget by a similar amount, the result would be a greatly increased risk of dangerous climate change. For example, Figure 1 (p.4) shows that a seemingly modest increase of 11 percent in the stabilization target (from 450 to 500 ppm CO_2eq) will increase the chances of a greater than 2°C increase in global average temperature from 50-50 to 70-30, and of a greater than 3°C increase from 30-70 to 50-50.

Significantly, not one of the proposals comes close to meeting the lower end of the U.S. emissions budget range (160 $GtCO_2eq$ for the period 2000–2050). Several (H.R. 1590, S. 309, S. 485) do provide for congressional review and periodic reports by the National Academy of Sciences to ensure the emissions reduction targets remain consistent with the goal of holding the increase in global average temperature below 2°C. Given the 30 percent probability that the global average temperature may even rise more than 3°C at the 450 ppm CO_2eq stabilization level, a requirement for periodic review is an essential element of any robust U.S. policy aimed at achieving emissions reductions consistent with avoiding dangerous climate change.

A comparison of federal climate policy proposals in terms of cumulative U.S. emissions relative to the U.S. emissions budget range of 160 to 265 $GtCO_2eq$ defined in this analysis. Only H.R. 1590 (Waxman) and S. 309 (Sanders-Boxer) do not exceed the upper limit of the budget, and even these proposals result in emissions well above the low end of the range possible with a 450 ppm CO_2eq stabilization target.

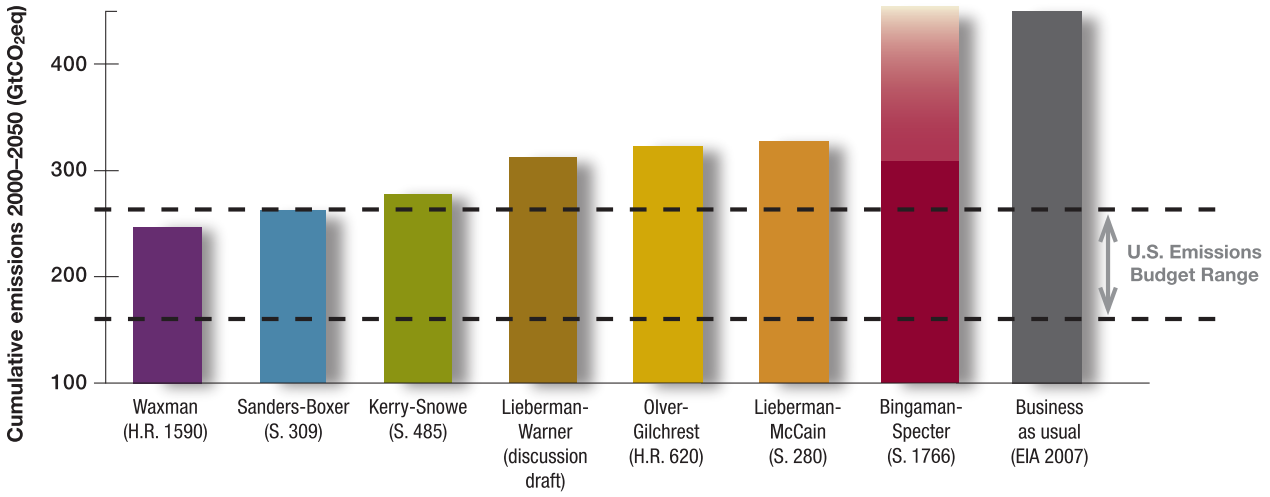
For S. 1766 (Bingaman-Specter), the potential range of cumulative emissions for 2000–2050 is provided. The lower portion of the bar indicates cumulative emissions for S. 1766 under the best-case scenario, in which the bill's price ceiling is never triggered, all emissions reduction targets out to 2030 are met, and all of the conditions needed to achieve the 2050 target are met, including international action, a recommendation by the president to Congress, and additional congressional legislation. This scenario also assumes that the 2050 target reduces total (economy-wide) U.S. emissions 60 percent below 2006 levels, even though earlier targets reduce emissions for only 85 percent of the economy. The color gradient in the upper portion of the bar represents the uncertainty in the additional cumulative emissions that would occur if the bill's price ceiling were triggered. (The darker the color, the more likely it is that total cumulative emissions would reach that level.) The gradient is for illustrative purposes only and does not represent explicit modeling of the price ceiling's effect on emissions decisions. The range depicted here assumes that if the price cap is triggered, the total cumulative emissions could approach those projected by the EIA under a low-growth "business as usual" scenario.

Figure 7a. U.S. Emissions Reductions under Federal Proposals



*The upper bound of this area was defined as the lowest average annual emissions reductions from 2010–2050 that would keep total cumulative U.S. emissions from exceeding the upper limit of the U.S. emissions budget defined in this study. The lower bound was defined as the lowest average annual emissions reductions from 2010–2050 that would keep total cumulative U.S. emissions from exceeding the lower limit of the budget.

Figure 7b. Cumulative U.S. Emissions in 2050 under Federal Proposals



VIII. The Way Forward

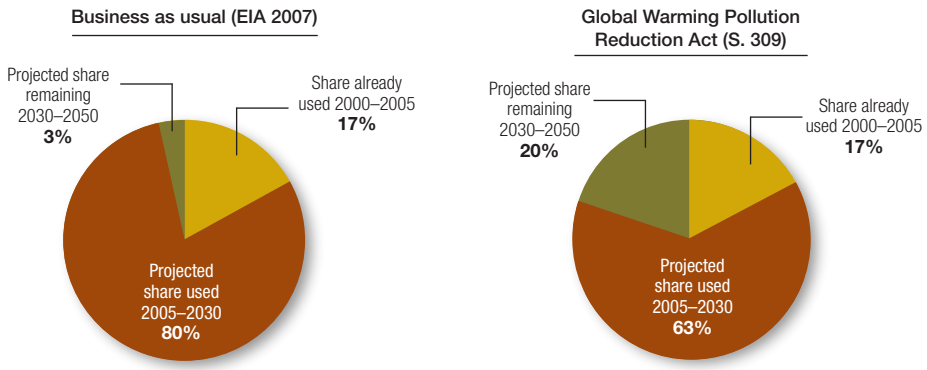
In summation, global heat-trapping emissions must be reduced between 40 and 50 percent from 2000 levels by 2050. This target will maintain a medium probability of preventing the global average temperature from rising more than 2°C above pre-industrial levels, which would greatly increase the risk of dangerous climate change. In this study we have developed a U.S. emissions reduction target consistent with that goal: at least 80 percent below 2000 levels by 2050, with a total emissions budget of 160 to 265 $GtCO_2eq$ for the period 2000–2050.

There are a number of possible emissions pathways consistent with these criteria. However, a clear message emerges from this analysis: if smaller near-term reductions are pursued or reductions continue to be delayed, we risk exceeding the U.S. emissions budget within a much shorter time frame—as soon as 2030 on one business-as-usual pathway (EIA 2007) (Figure 8).

As this analysis demonstrates, the United States must quickly overcome its current impasse on climate policy if we are to avoid dangerous climate change. Quick action would provide a longer time frame for reducing emissions, which in turn would allow greater flexibility in both the choice and cost of mitigation options. In addition, optimal long-term investment decisions could be made in earlier decades, so that new technologies could be developed and deployed in later decades.

Many solutions are already available, including greater energy efficiency, increased use of renewable energy, and reductions in deforestation. These changes can be encouraged by a wide range of market-based and complementary policies, such as cap-and-trade programs, renewable electricity standards, efficiency standards for electricity and vehicles, and incentives for cleaner technologies and international cooperation on emissions reductions. The way forward should emphasize economic growth that is not dependent on fossil fuel use and responsible choices that nations, companies, and individuals can make to lower the risk of dangerous climate change while permitting economic development to continue in a sustainable manner.

FIGURE 8. Spending the U.S. Cumulative Emissions Budget



Under a "business as usual" scenario, the United States would use nearly all of its emissions budget by 2030, requiring unrealistically drastic cuts thereafter to achieve the 450 ppm CO_2eq stabilization target by 2050. In contrast, the emissions cuts required by S. 309 (the Global Warming Pollution Reduction Act) would allow reductions to proceed in a more gradual fashion, providing greater flexibility in the method and timing of reductions.

Box 3. Lessons Learned in California

Motivated by the energy crisis of the 1970s, California has instituted a broad range of policies to encourage energy conservation. As a result, the average Californian consumes 40 percent less electricity than the average American (EIA 1999), and the state's consumers saved $56 billion in energy costs between 1975 and 2003 from building and appliance efficiency standards alone (Brown 2005). These trends have not hurt California's economic growth—the state ranks as the eighth largest economy in the world (California Legislative Analyst's Office 2006). Its technology sector has been a major source of growth, during the boom years of Silicon Valley and now as a hub for the development of clean energy technologies.

Along with several other states, California is also leading the way in meeting the climate challenge. Governor Schwarzenegger acknowledged the serious economic and environmental risks of climate change by signing the Global Warming Solutions Act (AB 32) in 2005. The bill mandates emissions reductions to 1990 levels by 2020 and the state also has a long-term reduction goal of 80 percent below 1990 levels by 2050. To meet these goals, the state is considering a broad array of new policies and measures in addition to strengthening existing ones.

For example, California has a renewable electricity standard that requires the state's utilities to produce 20 percent of their electricity from renewable sources by 2010; it also includes a stated goal of extending the standard to 33 percent by 2020 (CAT 2006). State regulations governing new motor vehicles aim to reduce heat-trapping emissions from cars and trucks 18 percent by 2020 and 27 percent by 2030.[15] And several initiatives under way to encourage sustainable land-use planning could also help California meet its reduction targets (CAT 2006).

According to a report commissioned by the governor on the potential of different policies to contribute to California's 1990 levels by 2020 target, this goal is not only achievable but would also produce net economic gains (CAT 2006). Preliminary macroeconomic analysis shows that implementation of these strategies would result in a net increase of 83,000 jobs and $4 billion in revenue—above and beyond business-as-usual growth—by 2020 (CAT 2006). These gains are a direct result of cost savings from reduced energy use and the beneficial impact of technological innovation.

Notes

[1] 2006 levels are approximately 20 percent above 1990 levels according to data from the U.S. Environmental Protection Agency.

[2] CO_2-equivalent units are used to compare the cumulative heat-trapping effects of a given concentration of different gases and aerosols (over a specific time frame) with an equivalent concentration of CO_2.

[3] With a median estimate of climate sensitivity to heat-trapping emissions, this scenario stays under 2°C. However, higher possible levels of sensitivity would cause temperatures to increase more than 2°C.

[4] These budgets are estimated based on CO_2-equivalent emissions from all greenhouse gases. In Meinshausen et al. (2006), emissions for all gases are reported explicitly. Data can be downloaded from *http://www.simcap.org*. In Baer and Mastrandrea (2006), only CO_2 emissions are reported explicitly, but we scale these emissions to CO_2-equivalent units by assuming the same ratio of CO_2 to non-CO_2 gases found by Meinshausen et al. In that study, the ratio of global fossil CO_2 to global CO_2eq (i.e., all CO_2 including land use and land cover change, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) is approximately 1.4.

[5] The IPCC Fourth Assessment Report includes a summary of stabilization scenarios from energy/economic models, not including scenarios that peak above the final stabilization level. Without such a peak, scenarios included in the summary that stabilize at approximately 450 to 500 ppm CO_2eq require 50 to 85 percent reductions in global emissions below 2000 levels (Fisher et al. 2007).

[6] This pathway was generated using standard carbon cycle assumptions with climate feedbacks, and considered all emissions of CO_2 and other key heat-trapping agents (non-CO_2 greenhouse gases, ozone precursors, and sulfate aerosols). The non-CO_2 emissions were generated using the "equal quantile walk" method, an approach derived from the relationships between CO_2 and non-CO_2 gases in the existing multi-gas IPCC baseline and stabilization scenarios (Meinshausen et al. 2006). Note that we use the emissions budget from this pathway, but do not constrain our analysis to the year-to-year emissions followed by the pathway (provided the cumulative budget is still reached). Note also that because the 500 ppm CO_2eq peak associated with this pathway is dependent on the magnitude and timing of emissions reductions, changes to the magnitude and timing of reductions may induce concentrations to peak at a level other than 500 ppm.

[7] This budget refers to all greenhouse gas emissions including those from land use and land cover changes.

[8] There are many different global emissions pathways that can stay within the same cumulative emissions budget, with different timing of reductions and varying rates of reduction among different heat-trapping gases. As previously discussed, we use the Meinshausen et al. (2006) budget as a constraint, but do not constrain the timing of reductions to match the pathway defined in the Meinshausen et al. study.

[9] The timing and scale of required reductions in energy-sector emissions will also be affected by the future trajectory of CO_2 emissions from deforestation in developing countries (which currently accounts for almost 20 percent of human-caused heat-trapping emissions). Gullison et al. (2007) estimate that aggressive but achievable reductions in deforestation could avoid the release of up to 180 $GtCO_2$ by 2100.

[10] As previously described, we calculated CO_2eq as the sum of all greenhouse gases including land use and land cover change. We estimated non-fossil CO_2 and non-CO_2 emissions assuming the regional constituent ratios found by Meinshausen et al. (2006). The average ratio for the industrialized world is 1.3 CO_2eq to CO_2; the average ratio for developing nations is 1.7.

[11] This is equivalent to reductions of at least 78 percent below 1990 levels, or at least 82 percent below current (2007) levels.

[12] As previously discussed, there are multiple pathways that will lead to the same cumulative emissions. One example is displayed in Figure 3.

[13] Based on U.S. emissions for the period 2000–2005 (EPA 2007).

[14] The EIA Low Projection is used for consistency with the budget analysis.

[15] Implementation of this regulation requires a waiver under the Clean Air Act from the U.S. EPA; the waiver was still pending at press time.

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Appendix

Emissions Reduction Targets in Federal Multi-Sector Climate Bills

This table describes the regulated sectors and emissions reduction targets required by seven major federal climate bills. Targets for the year 2050 are compared with the 2000 emissions levels provided in the April 2007 Environmental Protection Agency (EPA) Inventory of U.S. Greenhouse Gas Emissions and Sinks for 1990–2005.

	H.R. 1590 Waxman (D-CA): **Safe Climate Act of 2007**	**H.R. 620** Olver (D-MA)-Gilchrest (R-MD): **Climate Stewardship Act of 2007**	**S. 280** Lieberman (I-CT)-McCain (R-AZ): **Climate Stewardship and Innovation Act of 2007**	**S. 309** Sanders (I-VT)-Boxer (D-CA): **Global Warming Pollution Reduction Act**	**S. 485** Kerry (D-MA)-Snowe (R-ME): **Global Warming Reduction Act of 2007**	Lieberman (I-CT)-Warner (R-VA): **America's Climate Security Act of 2007** (proposal language only)[1]	**S. 1766** Bingaman (D-NM)-Specter (R-PA): **Low Carbon Economy Act of 2007**
Coverage	Economy-wide. Regulated entities to be determined by the EPA; provides for regulatory standards for electricity generation, fuels, and transportation.	Covered sectors include electric power, industrial or commercial facilities that emit more than 10,000 metric tons (mt) CO_2eq per year, and petroleum refineries or importers in the transportation sector that release more than 10,000 mt per year. According to the EPA inventory, the covered sectors represent 85% of the economy, but coverage will likely be significantly lower because of exempted sources.[1]	Covered sectors include electric power, industrial or commercial facilities that emit more than 10,000 metric tons (mt) CO_2eq per year, and petroleum refineries or importers in the transportation sector that release more than 10,000 mt per year. According to the EPA inventory, the covered sectors represent 85% of the economy, but coverage will likely be significantly lower because of exempted sources.[1]	Economy-wide. Regulated entities to be determined by the EPA; provides for regulatory standards for electricity generation and transportation.	Economy-wide. Regulated entities to be determined by the EPA; provides for regulatory standards for electricity generation, fuels, and transportation.	Covered sectors include electric power, transportation, and industrial entities (as defined in the EPA inventory) that emit more than 10,000 metric tons (mt) CO_2eq per year. According to the EPA inventory, these sectors represent 80% of the economy, but coverage will likely be significantly lower because of exempted sources.[1]	Petroleum refineries, natural gas processing plants, fossil fuel importers and producers, and non-CO_2 gas importers, as well as coal facilities that use more than 5,000 tons of coal per year (mainly utilities). According to the emissions reduction target chart in the bill (Sec. 101), these sectors represent 85% of the economy. The bill sets a ceiling on the price of emissions allowances, allowing covered sources to pay into a fund instead of making emissions reductions if the price ceiling is exceeded.[1]
Emissions Reduction Targets							
2010	Emissions reductions begin.	Starting in 2012, emissions from covered sectors must be 6,150 million metric tons (mmt) CO_2eq. [4]	Starting in 2012, emissions from covered sectors must be 6,130 million metric tons (mmt) CO_2eq.[4]	Emissions reductions begin; 2% annual reduction 2010–2020.	Emissions reductions begin.	2005 levels by 2012 for covered sectors.[4]	Emissions reductions begin in 2012.
2020	1990 levels by 2020, with a 2% annual reduction 2011–2020.	From 2012–2019, emissions stay at 6,150 mmt CO_2eq.	From 2012–2020, emissions stay at 6,130 mmt CO_2eq.	1990 levels by 2020.	1990 levels by 2020.	10% below 2005 levels for covered sectors.	2006 levels.
2030	5% annual reduction 2021–2050.	From 2020–2029, emissions must be 5,232 mmt CO_2eq for covered sectors.	From 2021–2030, emissions must be 5,239 mmt CO_2eq for covered sectors.	One-third of 80% below 1990 levels.	2.5% annual reduction 2021–2030.	30% below 2005 levels for covered sectors.	1990 levels.
2040	5% annual reduction 2021–2050.	From 2030–2039, emissions must be 3,858 mmt CO_2eq for covered sectors.	From 2031–2040, emissions must be 4,100 mmt CO_2eq for covered sectors.	Two-thirds of 80% below 1990 levels.	3.5% annual reduction 2031–2050.	50% below 2005 levels for covered sectors.	
2050	5% annual reduction 2021–2050, reaching 80% below 1990 levels by 2050 (83% below 2000 levels).	Beginning in 2050 and thereafter, emissions must be 1,504 mmt CO_2eq for covered sectors (57% below 2000 levels).[4]	Beginning in 2050 and thereafter, emissions must be 2,096 mmt CO_2eq for covered sectors (47% below 2000 levels).[4]	80% below 1990 levels by 2050 (83% below 2000 levels). If CO_2eq concentrations exceed 450 ppm or if global average temperatures increase by 2°C above pre-industrial levels, reduction targets would accelerate.	3.5% annual reduction 2031–2050, reaching 65% below 2000 levels by 2050.	70% below 2005 levels for covered sectors (47% below 2000 levels).[4]	Conditional target of at least 60% below 2006 levels by 2050, contingent on sufficient international action as determined by interagency review, presidential recommendation to Congress, and subsequent congressional action.

(*footnotes on next page*)

[1] The information presented here could change once the proposal is introduced as legislation.

[2] Some external analyses suggest that exempted and other uncapped sources could reduce the bill's coverage to as little as 74% of the economy. However, our analysis assumes complete sector coverage for simplicity.

[3] If the price ceiling is exceeded, emissions reductions could slow or cease. In that event, the bill's emissions reduction targets would not be met.

[4] We assume emissions levels specified in the bill pertain to covered sectors only. We assume uncovered sectors grow at the "business as usual" rate projected by the Energy Information Administration's low-growth scenario (EIA 2007).

[5] Section 101 of the bill sets emissions levels for each year from 2012–2030. The bill's 2012 emissions level is consistent with 85% of the economy-wide emissions for that year as projected by the EIA. For this reason, we assume the bill's covered sectors represent 85% of the economy, with uncovered sectors growing at the "business as usual" rate projected in EIA 2007.

HOW TO AVOID DANGEROUS CLIMATE CHANGE

A Target for U.S. Emissions Reductions





Substantial scientific evidence indicates that an increase in the global average temperature of two to three degrees Celsius above pre-industrial levels poses severe risks to natural systems and human health and well-being. To avoid such dangerous climate change, every nation must reduce its emissions of carbon dioxide (CO_2) and other heat-trapping gases.

This report draws upon the best available science to set a sound long-term U.S. emissions reduction target consistent with the goal of stabilizing the concentration of heat-trapping gases in the atmosphere at or below the CO_2 equivalent of 450 parts per million (450 ppm CO_2eq). To meet this goal, our analysis shows that the United States must reduce its emissions *at least* 80 percent below 2000 levels by 2050 and limit its total cumulative emissions for the period 2000–2050 to no more than 160 to 265 gigatons CO_2eq. The report also assesses which of the bills currently under consideration in Congress could meet this target.

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Union of Concerned Scientists
Citizens and Scientists for Environmental Solutions

November 5, 2009

RECEIVED
NOV 5 2009
10:15 am
CITY OF COLTON
REDEVELOPMENT AGENCY

Candace E. Cassel
Economic Development Dept
City of Colton
650 N La Cadena Dr
Colton, CA 92324
[Hand delivered to City of Colton]

RE: City of Colton West Valley Specific Plan and EIR

My comments regarding the City of Colton's West Valley Specific Plan and EIR, as portrayed on the City's website, are as follows:

My credentials for remarking on the referenced documents include nearly fifty years of entomological studies and professional work, including both BS and MS degrees in Entomology from the University of California at Riverside, an enduring interest in the so-called "giant flower-loving flies" (*Rhaphiomidas*), author of the petition to USFWS to list the Delhi Sands Giant Flower-loving Fly (*Rhaphiomidas terminatus abdominalis*, aka DSF) as an Endangered Species, over forty years experience observing various *Rhaphiomidas* species in the field, and currently certified by USFWS to conduct DSF surveys. In recent years I have appeared before the Colton City Council and been consulted by the City's administrative staff and HCP consultant, Tom McGill, regarding the planned "Super Block" development, now known as the West Valley Specific Plan (WVSP), and potential mitigation measures in the event that existing DSF habitat within the WVSP were converted to other developed uses.

The WVSP EIR proposes two alternatives for mitigation of loss of DSF habitat within the WVSP area. Both alternatives require preservation and restoration, if necessary, of other lands suitable for DSF, but not now conserved for that purpose, either east of Meridian Avenue or south of Interstate 10 (including credits for the Vulcan Mitigation Bank). In my professional opinion, neither mitigation option, as described, is adequate nor would compensate for the impacts.

The proposal to conserve lands linking relatively high quality DSF habitat and relatively high density DSF subpopulations present on the so-called "hospital DSF preserve" and on land just east of the Hermosa Cemetery would include land along the east side of Meridian Ave. and south of C St. In order for this plan to work, it must be enlarged to include <u>all</u> the cemetery land east of the developed portion of the cemetery parcel, which is now actually and/or potentially occupied by DSF (not the lesser portion indicated in the EIR), extending south to C Street, plus restorable DSF habitat lands south of C Street and west of Hermosa Ave. to the northern boundary of the school at the corner of Hermosa Ave. and Valley Blvd. This would entail removal of all structures along the south side of C street and west of Hermosa Ave. (homes, out buildings, etc) inconsistent with DSF habitat and restoration of those lands to functional DSF habitat.

The adage "a bird in the hand is worth two in the bush" applies here with respect to occupied DSF habitat and mitigation lands proposed for habitat restoration. The fact is that observed subpopulations of DSF within the footprint of the proposed WVSP are generally much higher (and among the highest reported among all DSF subpopulations) than those within the proposed exchange habitat lands east of Meridian Ave. This is likely due, at least in part, to land disturbance which has greatly reduced native vegetation and promoted weedy grasses and other non-native plants, not to mention the recent frequent surface disturbance, all of which has greatly diminished the quality of DSF habitat in the proposed exchange lands. In order for these lands (east of Meridian Ave.) to support a DSF population equivalent to what would be lost in the WVSP footprint, they would need a great amount of ecological remediation in the form of weed suppression and reintroduction of native plants and animals comprising the Delhi Sands Natural Community. Without any further soil disturbance (and if non-native plants were eliminated), the lands would probably naturally become recolonized by native plant species, their insect associates (probably including DSF), and other members of the Delhi Sands community. That process could take at least a decade; but even then, there is no guarantee that the DSF would reoccupy the site and attain a population density as great as that which would be lost within the WVSP footprint.

The proposal to purchase mitigation credits from the Vulcan DSF Mitigation Bank also has problems. The mitigation bank may not have sufficient credits available. But, even if sufficient mitigation credits were available to the City of Colton, that mitigation bank has not yet demonstrated that it can restore degraded habitat to the equivalence of what would be sacrificed. However, supposing that sufficient mitigation bank credits could be purchased, and that the lands were to be restored to a condition able to support an equivalent population of DSF, the WVSP EIR should specify that level of mitigation. Furthermore, the WVSP EIR should specify that the DSF occupied lands within the WVSP footprint would not be sacrificed prior to functional restoration of the mitigation bank lands, including demonstration of at least equivalent level of DSF population density, to be verified/certified by USFWS. This same level of demonstrated DSF occupation of restored lands should apply as well to the lands along Meridian Ave. (described above), should that alternative be utilized.

The practicality of adequately mitigating for proposed take of DSF occupied habitat within the WVSP footprint is questionable. To date, no entity has demonstrated that degraded DSF habitat can be restored to full functionality *vis-à-vis* DSF productivity and population stability. In my opinion, such a task would require at least a few years of restoration work and perhaps some luck. Because the DSF is a top level predator (in the larval stage), it requires an established community of soil-dwelling insects for its prey. The prey species, in turn, cannot thrive until the plant community upon which they depend has been restored. Thus, DSF cannot become established immediately within restored habitat; it can only do so after other potential prey species have become established. Thus, time is the key ingredient (aside from appropriate soil substrate) in restoring DSF habitat and in establishing a viable DSF population.

Because nearly all currently DSF-occupied habitat has been disturbed (graded, disced, cultivated, and/or otherwise denatured) in the past, it is evident that degraded Delhi Sands habitat can become recolonized by native plants and animals, including DSF, given sufficient time. Such recolonization is not immediate and seems to occur over a period of a few to several years (*e.g.* apparently at least 5 years

after grading in south Fontana), depending on the nature of disturbance, proximity to other established DSF populations, and condition of the land. It should be noted that the densest DSF subpopulations currently known occur on land parcels that apparently were never subjected to major land disturbance in historic times. Recreating such dense DSF populations on degraded and restored habitat, and in the absence of a demonstrated procedure and capacity for so doing, is the challenge facing the City of Colton if it moves forward with its WVSP.

My recommendation is that the City of Colton revise its WVSP EIR to:

1) include sufficient detail regarding proposed mitigations for take of DSF to ensure that proposed mitigations will completely mitigate for loss of DSF by establishing and/or enhancing DSF populations on conserved and restored habitat (mitigation lands) to a level equivalent to that which is proposed to be taken;
2) specify performance standards (criteria) to ensure that DSF population size and/or density on mitigation lands be measured annually until it equals or surpasses historical levels for DSF-occupied parcels within the WVSP footprint;
3) Specify that the DSF-occupied parcels within the WVSP footprint will not be altered (no take of DSF) until observed DSF population size and/or density on mitigation lands equals that on the WVSP parcels contemplated for taking.

Sincerely,



Greg Ballmer
5894 Grand Ave.
Riverside, CA 92504

City of Rialto
California

Rec'd 11-5-09
originally Rec'd via facsimile @ 10:42 am on 11-5-09

November 4, 2009

Candace E. Cassel, Redevelopment Director
Redevelopment Agency/Economic Development
650 N. La Cadena Drive
Colton, CA 92324

Re: West Valley SP Amendment Comments

Dear Ms. Cassel:

The City of Rialto has reviewed the Draft EIR for the West Valley Specific Plan amendment. We have compiled a list of significant impacts that must be addressed in the draft EIR.

Comments on Introduction, Executive Summary& Project Description

1. The project boundary for the West Valley Specific Plan amendment includes an 11.4 acre site located within the boundaries of the City of Rialto. The draft EIR must be modified to show the correct project boundary on Exhibits 3-2, 3-4, 3-5 3-7, 3-8, 3-11, 3-13, 3-14. The Overview, Project Summary and Project Description of the Draft EIR must be modified to reflect the ***correct*** project boundary. The site has a zoning designation of Gateway Specific Plan, Office Park. Any development of the site is subject to the requirements of the Plan. A Specific Plan Amendment application is required by the City of Rialto to amend the Gateway Specific Plan.

2. Because a portion of the project falls within the boundaries of the City of Rialto, Rialto is a Responsible Agency pursuant to California Environmental Quality Act (CEQA). Rialto must be listed as a Responsible Agency in the draft EIR. Since the lead agency discussion on page 1-4 of the EIR asserts that Rialto Unified School District is listed as a responsible agency because the 11.4 acre site is wholly within their district, then the City of Rialto must be included as a responsible agency since the land is certainly "wholly within" our boundaries as well. Rialto is not listed as a responsible agency in section 3.3.2 of the draft EIR.

3. Section 1-4 of the EIR does not list the City of Rialto Gateway Specific Plan as a document incorporated by reference though a portion of the project area lies within the Plan.

4. Exhibit 3-6 is labeled as Existing Land Uses but is referred to as Conceptual Land Uses on page 2-2 of the draft EIR. Option 'A' land use plan discussion on page 2-2 states that PA 8 will be designated as the school site, but is not labeled as such.

5. Exhibit 3.11, labeled Conceptual Land Use Plan, shows that the project is inconsistent with the Rialto Gateway Specific Plan and the Rialto General Plan. This inconsistency has not been addressed.

6. Section 3.3.1 does not list the required Specific Plan Amendment and General Plan Amendment necessary to modify the Rialto Gateway Specific Plan and the Rialto General Plan for the school site.

7. Streets F-F and C-C shown on Exhibit 3-11 are not consistent with the street cross sections shown in the City of Rialto Gateway Specific Plan or the Circulation Element of the Rialto General Plan.

8. Table 3.2-3 excludes the Rialto portion of PA 6.

9. The draft EIR states that a "Habitat Conservation Plan (HCP) is being prepared concurrently with the draft EIR" for the West Valley Specific Plan Amendment. A decision on the proposed Specific Plan Amendment or on the draft EIR for the Amendment without an HCP that has been reviewed pursuant to CEQA and approved by the United States Fish & Wildlife Service or incorporated as a part of the Draft EIR will conflict with the requirements of CEQA.

Comment on Air Quality

1. The proposed school is a sensitive receptor and shall be addressed in the Health Risk Assessment and identified in Exhibit 4.2-2 and Table 4.2-13.

Comment on Land Use and Planning

1. The project will have significant impacts to land use and planning within the City of Rialto and is not consistent with the Rialto Gateway Specific Plan and the Rialto General Plan. The City of Rialto is not aware of any authority held by the City of Colton to designate land use for a parcel that is not within its boundaries unless the site is proposed to be annexed into the City of Colton and an application will be filed with Local Agency Formation Commission.

Comments on Transportation and Traffic

1. The EIR shall include the Renaissance and Lytle Creek development projects in the traffic impact analysis.

2. The traffic impact analysis shall evaluate the project impacts on the arterial – regional roads in Rialto: Cedar Avenue, Cactus Avenue, Riverside Avenue, Pepper Avenue, the State Route 210 interchanges, Base Line Road, Foothill Boulevard, Rialto Avenue, Merrill Avenue, San Bernardino Avenue, Valley Boulevard, the Interstate 10 interchanges, Slover Avenue, Santa Ana Avenue, Jurupa Avenue and Agua Mansa Road.

3. Expand Table 4.12.3 to include the Rialto arterials identified in item No. 2 above and the impacted intersections.

4. Identify impacts on Rialto intersections and fair share mitigation of impacts.

5. The transportation and traffic portion of the report, in general, does not provide fair share mitigation of the project impacts, but appears to pass the mitigation to development as development occurs.

6. What is proposed for the project (City) fair share funding for the State Route 210 / Pepper Avenue interchange?

Comments on the Traffic Impact Analysis

1. **The Traffic Study did not address impacts at several intersections such as Sycamore/San Bernardino Avenue which abut the site.** (Wildrose appears to be severely impacted – Sycamore will likely require signalization given the increased traffic generated form the project.) This impact is not identified in any of the mitigation measures.

2. **The estimated number of project trips is not consistent in the Traffic Study.**

Page 22:	Table 3 – Page 26
57,406 daily vehicle trips	58,209 daily vehicle trips
3,128 Morning Peak	3,449 Morning Peak
5,492 Evening Peak	5,553 Evening Peak

3. **Table 2 Trip Generation Rates underestimates the potential traffic impacts. The number of traffic trips is understated for office, residential and retail uses.**
   a. PA 3 is not fully developed (Refer to aerial photo) but no new traffic is calculated (+3,000 tpd)
   b. The study deducts trips generated by the Ford Dealer in PA 15 which is closed.
   c. The data is inconsistent in Table 2 and Table 3.
   d. Table 2 cites ITE trip generation rates from land use categories 220, 230, 310, 411, 520, 710, 770, and 820 that do not reflect the types of uses that are likely to be developed (medical office vs. general office, single family residences vs. condos, and gas, convenience/fast food restaurants vs. general retail near freeway.)

Land Use	Description		Trip Rate	Rialto Comment
220	Apartment	(Unit)	6.72	May be low due to SFR Detached Units
230	Condo/Townhouse	(Unit)	5.86	
310	Hotel	(room)	8.17	
411	City Park	(acre)	1.59	
520	Elementary School	(student)	1.29	
710	General Office	(1,000 sf)	11.01	Not reflected in Table. (Medical Uses) Table 2 reflects Office from 13.39 to 15.73 trips @ tsf.
770	Business Park	(1,000 sf)	12.76	
820	Shopping center	(1,000 sf)	42.94	Not reflected in Table. (Use/Rates?)

4. The WVSPA states (Page 3-3) "The Office use designation provides for general and medical uses ...with close proximity to the Arrowhead Regional Hospital Center, medical office opportunities exist in all four planning areas." Medical office uses will likely comprise a large portion of the office space demanded and land use. Medical office uses generate three times (36.13 trips @ tsf) the trips that are generated by general office uses. This is not addressed in the Traffic Analysis.

5. Table 2 does not reflect potential intensity of development. Although a FAR of 35% is typical of one-story office development, the WVSPA will allow up to *"three story or more"* office buildings and *no maximum FAR*. Given the ability to develop buildings with three or more stories, the estimated 35% FAR is excessively low to *"adequately and conservatively"* estimate potential number of traffic trips and that will be generated in the Office Land Use zone.

6. Table 2 cites source data from ITE Land Use 820 - Shopping Center at 42.94 trips (See PA 33 aerial). However, the retail uses that are likely to develop near the freeway will generate trips well in excess of the rates stated in Table II. These trips in the table are very low estimates given the types of retail proposed in the Specific Plan and the kind of retail likely near freeway.

7. PA- 15 is designated as a BP- Business Park in the WVSPA but the traffic study indicates it will be developed into a 132,313 square foot *shopping center*. Retail Uses are not listed as permitted uses in the WVSPA.

8. The rates used in Table 2 for condos and apartments ranging from 5.86 – 6.72 trips and do not reflect the single family detached homes that will be built and are allowed in the Res-M and Res-M-l zones of the WVSPA. The RES-M-l zone allows 7-12 du/ac and the list of Permitted Uses includes "Single Family Detached Homes with condos permitted". The RES-M-l zone allows 10-14 du/ac and the list of Permitted Uses includes Single Family Detached and Single Family Attached homes. The Traffic Study only uses the Condominiums / Townhomes trip generation rates. Up to 630 of the 1,293 units permitted in the Res-M and Res-M-1 zones may be Single Family Residential (SFR) detached homes. This will result in an increased trip rate of 9.57 for SFR land uses.

9. A spread sheet is attached showing that the project will actually generate a total of nearly 100,000 trips versus the 58,000 trips specified in the draft EIR (see attached spread sheet).

Comments on Scoping Meeting& Market Analysis

1. The draft EIR failed to address comments made at the scoping meeting by the City of Rialto. Rialto City staff attended the scoping meeting on April 24, 2008 and made a formal request to include an economic analysis to address the project's potential negative impacts upon existing and planned retail projects located in the City of Rialto such as the existing Wal-Mart store and the planned Wal-Mart Super Center.

2. The draft EIR *traffic analysis* included the trips that may be generated from the Wal-Mart Supercenter. However, the *market study* did not recognize, identify and consider the proposed Wal-Mart Supercenter (250,000 s.f.) for the SW corner of San Bernardino and Riverside Avenue in the City of Rialto within the Colton Trade Area in its analysis.

3. In addition, the Market study indicates that demand is for 150,000 – 200,000 square feet of additional retail. In 1-5 years, development of this site will have a negative impact upon existing and planned retail developments with the City of Rialto. This impact shall be analyzed and addressed in the Land Use section of the draft EIR.

EXHIBIT II-5
DEMAND PROJECTIONS BY LAND USE TYPE
SUPERBLOCK MARKET AREA*

	Total, Project Years 1-5				Total, Project Years 6-10				Comments
Residential									
For-sale	4,500	to	5,500	units	4,950	to	6,050	units	
Rental	400	to	600	units	440	to	660	units	Addl 400-500 units pent-up
Retail	150,000	to	200,000	SF	165,000	to	220,000	SF	
Office									
General Office	50,000	to	65,000	SF	55,000	to	71,500	SF	
Medical Office	50,000	to	65,000	SF	55,000	to	71,500	SF	
Industrial/Bus. Pk.	1,500,000	to	2,000,000	SF	1,650,000	to	2,200,000	SF	
Hospitality	225	to	325	rooms	225	to	325	rooms	

* Market areas vary by land use type.

4. The Market Study only studied up to 346,500 square feet of retail on 31.8 acres (See Exhibit II-6 attached). However the draft EIR is proposing to develop over 700,000 square feet of retail on 73.3 acres which is more than double that which was studied in the Market analysis. Developing this amount of additional retail use is not supported in the market and would likely cause impacts to other existing retail development. This could cause significant fiscal impacts as a result of lower sales volumes, business closures, and higher vacancy rates.

5. The Economic Market Analysis is outdated and flawed. The City of Colton indicates that the land uses for the Super Block are based upon a Market Study (dated October 2007) which is based upon unrealistic market demand. The Superblock development exceeds the anticipated market demand for various land uses including commercial/retail, office and hotel demand as identified in the study.

   Commercial/Retail

Proposed Land Use Plan:	73.3 acres	707,632 Sq. Ft.
Studied in Market Study:	31.8 acres	346,500 Sq. Ft
Supportable:	150,000 – 200,000 (Project 1-5 years)*	
	165,000 -220,000 (Project 6-10 years)	
Capture Ratio:	**90%** (unrealistically high given competition)	

   Study assumes that the retail facilities may be built before the typical number of rooftops is established – This is highly unrealistic.

   Office

Proposed Land Use Plan:	18.65 acres	284,338 Sq. Ft. (at .35 FAR)
Studied in Market Study:	5.3acres	85,250 Sq. Ft
Supportable:	50,000 – 60,000 (Project 1-5 years)*	
	55,000 -71,500 (Project 6-10 years)	
Capture Ratio:	**25 – 40%**	

   Residential

   The market study was completed at the very height of the market and estimates that the demand would be for 1,000 units per year at prices from $350,000 - $500, 0000. It is likely that both the current and future residential demand will not recover to these levels for 5 – 10 years.

EXHIBIT II-7
FOR-SALE RESIDENTIAL PRODUCT TYPES
WEST VALLEY SPECIFIC PLAN AREA

Product Description	DU/AC	Mix	Unit Size Range		Avg SF	Recommended Price Range		Avg $	Absorption/Month
5K SF Lots	6.1	175	2,600	3,000	2,800	$470,000	$500,000	$485,000	3.0-4.0
4K SF Lots	7.6	111	2,200	2,800	2,500	$435,000	$480,000	$457,500	3.0-4.0
Z lot-3K SF Lots	8	90	2,100	2,600	2,350	$420,000	$460,000	$440,000	3.0-4.0
Alley Load	9	100	1,400	2,000	1,700	$370,000	$410,000	$390,000	4.0
Triplex	11	110	1,350	2,100	1,725	$330,000	$390,000	$360,000	4.0-6.0
Row TH	12	122	1,400	2,000	1,700	$325,000	$370,000	$347,500	4.0-6.0
TH w/ Flats	14	192	1,300	2,000	1,650	$300,000	$355,000	$327,500	4.0-6.0
Condos	18	150	1,000	1,500	1,250	$255,000	$295,000	$275,000	8.0

Comments on Hydrology and Water Quality

1. The proposed project impacts two regional flood control facilities – the Rialto Channel system and the Project 3-5 system. Improvements to these systems are necessary to mitigate the drainage impacts resulting from the project. The Rialto Channel system requires improvement of reaches or portions of the system downstream of the Interstate 10. What is the proposal for mitigation of the project impacts to the Rialto Channel system?

2. The proposed detention basins in Exhibit 4.7-3 may be considered interim drainage facilities until such time as ultimate facilities are constructed. This does not provide fair share mitigation of the project impacts, but appears to pass the mitigation to development as development occurs.

3. Regional Project 3-5 improvements have been constructed to Valley Boulevard. What is proposed for the project fair share funding of further improvements to the Santa Ana River, thus, providing an outlet for drainage from areas of Colton, San Bernardino, Rialto and the unincorporated County?

4. Project impacts will include the localized flooding conditions along Valley Boulevard on the north side of Interstate 10. How will the project mitigate these drainage impacts?

5. The Water Quality Management Plan (WQMP) requirements should include the most recent criteria in the draft 2009 order, including requirements for streets and highways. The Best Management Practices should also be included.

Comments on Public Works Issues

1. Comments from the City of Rialto Public Works Department have been prepared and are attached to this letter.

Though the City of Rialto participated in the scoping meeting for this project, Appendix 'A' of the draft EIR and page 1-6 of the draft EIR do not reference the comments that we submitted. The City of Rialto requests a written response to these comments regardless of whether or not they are deemed "significant" by the lead agency as mentioned on page 1-12 of the draft EIR. The response to comments must be sent to:

City of Rialto
Development Services Department
Planning Division
150 S. Palm Avenue
Rialto, CA 92377

Please note that the City has also included a copy of the letter we received from the Rialto Unified School District. We would welcome an opportunity to discuss theses issues with the City of Colton. Please contact the Planning Division at (909) 820-2535 to arrange a meeting.

Sincerely,

Michael E. Story
Development Services Director

Attachments:
1) Excel Spread sheet
2) PA 3 Aerial
3) PA 33 Aerial
4) Exhibit II-6
5) Memo from the City of Rialto Public Works Department
6) Letter from Rialto Unified School District

cc United States Fish and Wildlife Service
Henry Garcia, City Administrator
Jimmy Gutierrez, City Attorney
Grace Vargas, Mayor
Robb Steel, Redevelopment/Economic Development Director
Ahmad Ansari, City Engineer/Public Works Director

Planning Area	Land Use	Acres	Sq. Ft Developed	Coverage / Density	Units	Trip Rate	Total Daily		Difference	Comments
1	Business Park	6.45	98,337	35.00%	TSF	12.76	1255			
2	Open Space / Detention	2.56	0.000		AC	0	0			
3	**Auto / Business Park[3]**	15.69	239.210	35.00%	TSF	0.00	0	12.76	3,052	Area is not fully developed -(See Aerial)
4	Business Park[3]	14.51	221.700	35.08%	TSF	0.00	0	12.76	2,829	Existing Use has impacts area, but not defined
5	Open Space / Park	5.52	0.000	0	AC	1.59	9			
6	School (K-6)	4.81	1100.000		ST	1.29	1419			
7	Apartments	7.88	126	16.0	DU	6.72	847			
8	Residential Condos	5.14	54	10.5	DU	5.86	316	9.57	200	
9	Open Space / Park	1.63	0.000	0.0	AC	1.59	3			
10	Residential Condos	5.13	54	10.5	DU	5.86	316	9.57	200	
11	Apartments	6.18	101	16.3	DU	6.72	679			
12	Residential Condos	3.72	101	27.2	DU	5.86	592	9.57	375	Traffic Study denotes 101 units in PA-12 (EIR states 47 units)
13	Open Space / Detention	2.82	0.000	0.0	AC	0.00	0.00			
14	Business Park	7.21	109.924	35.00%	TSF	12.76	1403			
15	Existing Ford Dealer	12.15	77.100		TSF	-2.64	-203.54	0		Deduction Trip Rate is not correct on Table 2
	Proposed Shopping Center	12.15	132.313	25.00%	TSF	61.57	8147			What Retail Category is being used . This in not 820. (Also is designated as BP in SPA)
16	Business Park	7.93	120.901	35.00%	TSF	12.76	1543			
17	Open Space / Detention	2.70	0.000	0.0	AC	0.00	0.00			
18	Residential Condos	6.62	84	12.7	DU	5.86	492	9.57	312	
19	Residential Condos	9.78	115	11.8	DU	5.86	674	9.57	427	
20	Residential Condos	6.6	84	12.7	DU	5.86	492	9.57	312	
21	Open Space / Park	4.6	0.000	0.0	AC	1.59	7			
22	Residential Condos	6.58	84	12.8	DU	5.86	492	9.57	312	
23	Residential Condos	10.32	108	10.5	DU	5.86	633	9.57	401	
24	Open Space / Park	0.7	0.000	0.0	AC	1.59	1			
25	Apartments	9.37	234	25.0	DU	6.72	1572			
26	Apartments	2.42	61	25.2	DU	6.72	410			
27	Apartments	5.65	141	25.0	DU	6.72	948			
28	Office	3.9	59.459	35.00%	TSF	15.04	894	36.13	2148.3	What Office Use - Next to Hospital - Mostly Medical Offices Are Likely
29	Office	6.45	98.337	35.00%	TSF	13.39	1317	36.13	3552.9	What Office Use - Next to Hospital - Mostly Medical Offices Are Likely
30	Business Park	21.74	331.448	35.00%	TSF	12.76	4229			
31	Office	5.1	77.755	35.00%	TSF	14.14	1099	36.13	2809	What Office Use - Next to Hospital - Mostly Medical Offices Are Likely
32	Office	3.2	48.787	35.00%	TSF	15.73	767	36.13	1763	What Office Use - Next to Hospital - Mostly Medical Offices Are Likely
33	Retail	3.16	34.412	25.00%	TSF	98.65	3395		1083	This will likely be developed with gas station/convenience and fast food uses
34	Hotel	7.3	413.000		RMS	8.17	3374		1,913	400 rooms is too many - Site will like be developed with one hotel, restaurants, gas station, fast food
35	Retail	61.82	673.220	25.00%	TSF	34.84	23455		15801	What Retail Category is being used . This in not 820.
36	Open Space / Habitat	16.91	0.000	0.0	AC	0.00	0			
	ROW	68.95								
Total		385.35	1,347				60,577		98,065	
							58,210			

[1] Source : ITE Trips Land Use Categories 220, 230, 310, 411, 520, 710, 770, and 820

Land Use	Description	Trip Rate
220	Apartment (Unit)	6.72
230	Condo/Townhouse (Unit)	5.86
310	Hotel (room)	8.17
411	City Park (acre)	1.59
520	Elementary School (student)	1.29
710	General Office (1,000 sf)	11.01
770	Business Park (1,000 sf)	12.76
820	Shopping center (1,000 GLA)	42.94

Other Land Use Categories or trip rates used in Office and retail uses.

[3] Currently in Operation

PA-33 Site would likely consist one service station/convenience market (3,500 sf / 8-10 pumps), and two fast food restaurants (3,200 each)

Land Use				
934	Fast Food w/ Drive Thru (1,000 sf)	3.2	496.12	1588
934	Fast Food w/ Drive Thru (1,000 sf)	3.2	496.12	1588
945	Service Station w/ Convince Market (1,000 sf)	3.5	162.78	
945	Service Station w/ Convenience Market (per disp	8	162.78	1302
				4477
			Difference	1083

PA- 34 Fully developed site would like also include a gas station, sit down rest taunt, and fast food

Land Use		Units/TSF		
310	Hotel (room)	200	8.17	1,634
932	Restaurant Sit Down (High Turnover)	6	127.15	763
934	Fast Food w/ Drive Thru (1,000 sf)	3.2	496.12	1,588
945	Service Station w/ Convenience Market (per disp	8	162.78	1,302
				5,287
			Difference	**1,913**

PA-35 This planning area is intended to contain destination and entertainment oriented retail uses, including a movie theater, restaurants

Retail	**61.82**	**673.220**		
Movie Theater		60,000	78.06	4684
Restaurants(high turn sitdown)		25000	127.15	3179
General Retail Shopping		250000	42.94	10735
Banks/		10000	156.48	1565
Apparel / Clothing Bouqtique		25000	66.4	1660
Quality Sit Down Restaruants		15000	89.95	1349
Freestanding Discount Retail center		250000	49.21	12303
Druetores/Pharmacy		25000	90.06	2252
Food stores		15000	102.04	1531
		675,000		39256



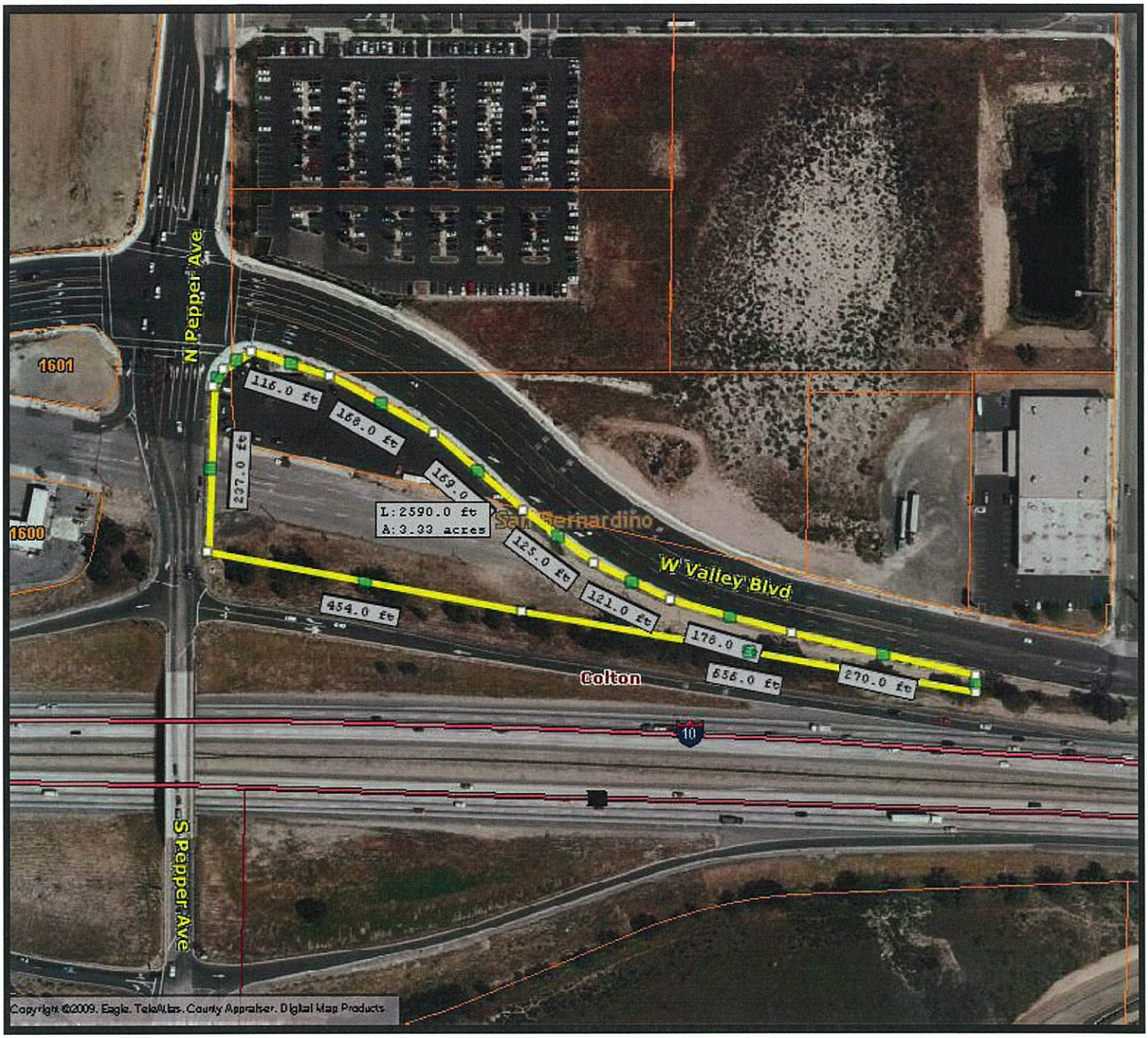
SOUTHERN CALIFORNIA
ASSOCIATION of GOVERNMENTS

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179 ft

RDIR

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SOUTHERN CALIFORNIA ASSOCIATION of GOVERNMENTS

PA-33

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RDIR

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Exhibit II-6 below contains a recommended Land Use Matrix, showing numbers of units and acreage devoted to each land use.

EXHIBIT II-6
MASTER LAND USE MATRIX
WEST VALLEY SPECIFIC PLAN STUDY AREA

Land Use Type		Units/Square Feet	UPA/FAR	Acres
Residential				
	For-sale	1,050	10	105.0
	Rental	525	25	21.0
Retail		346,500	0.25	31.8
Office				
	General Office	31,250	0.40	1.8
	Medical Office	54,000	0.35	3.5
Industrial/Business Park		921,500	0.25	83.8
Hospitality		413	0.35	6.8
DEVELOPED AREAS				**257.0**
Open Space/Roads/Parks/Miscellaneous				9.5
TOTAL PLANNED AREA				**266.5**

PUBLIC WORKS /Engineering

MEMO

To : Michael Story, Development Services Director

From : Ahmad R. Ansari, P.E., Public Works Director/City Engineer

Date: November 4, 2009

Re: **Public Works Comments on City of Colton West Valley SPA (Super Block) Draft EIR**

SPECIFIC PLAN CIRCULATION:

- Page 2-51:
  - Construction Truck Traffic Should be limited to Valley Bl. within the City of Rialto
- Page 4.12-5:
  - Policy 2.2: Add the provision of bus turn out in the language
  - Policy 3.3: Provide Proposed Truck Route Map
  - The City of Rialto Draft General Plan must be considered for any Circulation proposals/modifications such as Bike Routes, Truck Routes, Cross-Sections etc.
- Page 4.12-8:
  - Exhibit 4.12-1: Following intersections should be included in the study:
    - Riverside/Randall
    - Pepper/Randall
    - Pepper/Etiwanda
    - Riverside/Slover
    - Riverside/Santa Ana
    - Riverside/Resource-Industrial
    - Sycamore/San Bernardino
- Page 4.12-28:
  - Remove the mention of "conservative" scenario regarding the Internal Trip discount as it causes decrease in the trips

TRAFFIC IMPACT ANALYSIS:

- Page 22:
  - The numbers for Project Trip Generation doesn't match in Page 26

- Page 25, Table 2:
  - If the Ford Dealership was closed before the counts were taken, then the Trip Discount will not apply. Also the daily trip rate and daily trip calculation doesn't add up for Ford Dealership Landuse in Tables 2 and 3
  - Trip Generation calculation should include Medical Office use as mentioned through out the EIR document (Pages: 3-35, 3-40, 3-65 et al.) or the exact proportion of General and Medial Office uses should be documented and calculated accordingly
  - Trip Generation for Retail uses should be calculated separately as much as possible
  - Trip Generation for Single Family Detached uses should be calculated separately
  - The table doesn't reflect potential intensity of the development. The estimated FARs seem too low to adequately and "conservatively" estimate the number of traffic trips
  - For PA 3, the Trip Generation Discount could only be applied to fully developed parcels. This area is currently 80% underutilized/vacant. Proper Trip Generation must be added
  - For PA 15, retail use is listed under BP category
  - For PA33 and similarly located parcels, the combined Land Use of Shopping Center may not apply
  - For PA 34, the likelihood of 2-200 room hotel is minimum based on the current market trends and instead could develop into high traffic generating uses such Retail, Restaurants etc.
- Figures 11 thru 41:
  - Trip Distribution percentages to the east doesn't add up or not clear
  - Some of the trips should have been assigned to Riverside/I-10 EB Ramp
- Page 96, Figure 55:
  - It's unclear how the ADT on Riverside south of I-10 decreased in 2030 scenario from 2012 scenario
- Page 112: Include the cost of proposed improvements and corresponding Fair Share in dollars.

WATER & WASTEWATER

- The City of Rialto serves water west of Sycamore on Valley Blvd. East Sycamore is served by the City of Colton. The City of Rialto does not have any connections with the City Colton as the water system moves farther north along the boundary. The City of Rialto does have an emergency connection with the City of Colton on Baseline and Meridian.

- The City of Rialto does not have a wastewater connection on Sycamore and Valley with the City of Colton. The only connection the City of Rialto has with City of Colton is at the Agua Mansa lift station in the southern portion of the City.

RIALTO UNIFIED SCHOOL DISTRICT

182 East Walnut Avenue Rialto, California 92376-3598 Telephone (909) 820-7700 FAX (909) 873-2489

BOARD OF EDUCATION

Joseph Ayala

Joanne T. Gilbert

John R. Kazalunas, Ed.D.

Joseph W. Martinez

Michael G. Ridgway

JOSEPH G. DAVIS, Ed. D.
Deputy Superintendent
Business Services

October 30, 2009

City of Colton Economic Development Department
Attn: Candace Cassel
659 North La Cadena Dr.
Colton, CA 92324

RE: West Valley Specific Plan-DEIR September 2009

Dear Ms. Cassel:

We have reviewed the (DEIR) as described above and are stating that the Rialto Unified School District is directly impacted by this project as 260-304 acres of the proposed plan lies within the RUSD Boundaries.

The projected 1,293 dwelling units would produce 500 elementary students, 194 middle school students, and 321 high school students yielding 1,016 K-12 students within the Rialto Unified School District.

LAND USE PLAN-CONCEPTUAL

The 11.4 acre school site (PA 6) placed in this plan is located OUTSIDE THE SCOPE OF THE PROJECT in the City of Rialto. Therefore the 16.91 acres (PA-36) Delhi-sands flower-loving fly habitat does not mitigate a portion of the school site that is located in the City of Rialto. At this point in time, there is no mitigation in place for the 11.4 acres.

This plan is unacceptable to the Rialto Unified School District. The entire 16.21 acres dedicated for the school site must be included within the scope of the West Valley Specific Plan. Locating the site within the specific plan would provide better placement of the school in regards to traffic circulation and the overall safety of the students walking to and from school.

To date two (2) letters dated May 8, 2008 and September 18, 2008 have been submitted in response to the conceptual land use plan. These comments are noted in WVSPA-DEIR-September 2009 Section2: Executive Summary-Project Description 2.2.2.

LAND USE PLAN-OPTION A

Under this plan, the entire 14.8 K-8 school site (PA 8) is encompassed within the scope of the project, therefore, fully mitigated by (PA-36) Delhi-sands flower-loving fly habitat. This option is acceptable to the Rialto Unified School District. This Land Use Plan meets the criteria of positioning the entire school site within one jurisdiction and is mitigated by the Habitat Conservation Plan (HCP).

The Rialto Unified School District requests to be notified in writing in advance of any and all public hearings on this development. The Rialto Unified School district is empowered to collect all Mitigation Fees pursuant to Board of Education Resolution No. 08-09-68. The fee must be paid prior to the issuance of any building permits. Upon payment of fees, a Certificate of Compliance will be issued.

Thank you in advance for any further notifications and correspondence.

If you have any questions, please call 909.421.7555.

Respectfully,

Anna Ulibarri

Anna Ulibarri, Director
Facilities Planning

AU/kp

RECEIVED
NOV 5 2009
rec 10:45am
CITY OF COLTON
REDEVELOPMENT AGENCY

DEVELOPMENT SERVICES DEPARTMENT
FACSIMILE TRANSMITTAL SHEET

☐ BUILDING (909)820-2503 & 2505 ☒ PLANNING (909) 820-2535 ☐ ENGINEERING (909)820-2530

FAX NUMBER 909-873-4814

DATE: November 5, 2009

TO: Candace E. Cassel, Redevelopment Director

COMPANY: City of Colton Redevelopment Agency/Economic Development

PHONE: (909) 370-5167 FAX: (909) 370-5196

RE: West Valley Specific Plan Amendment Comments

FROM: Deidre Cook PHONE: (909) 820-2525 ext. 2011 EMAIL: Dcook@rialtoca.gov

CITY OF RIALTO
DEVELOPMENT SERVICES DEPARTMENT
ATTN: PLANNING
150 S. PALM AVENUE
RIALTO, CA 92376

TOTAL NUMBER OF PAGES INCLUDING COVER SHEET: 17

NOTES/COMMENTS: If you have any questions or comments regarding this document please contact Gina Gibson, Senior Planner, at (909) 421-7240.

PLEASE NOTIFY SENDER IMMEDIATELY IF THERE ARE ANY PROBLEMS WITH THIS TRANSMISSION.

HARDCOPY TO FOLLOW: ☒ **YES** ☐ **NO**

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DEPARTMENT OF PUBLIC WORKS

FLOOD CONTROL • LAND DEVELOPMENT & CONSTRUCTION
SOLID WASTE MANAGEMENT • SURVEYOR • TRANSPORTATION

COUNTY OF SAN BERNARDINO

825 East Third Street • San Bernardino, CA 92415-0835 • (909) 387-8104
Fax (909) 387-8130

GRANVILLE M. "BOW" BOWMAN, P.E., P.L.S.
Director of Public Works

November 3, 2009

RECEIVED
NOV 5 2009
1:10 pm
CITY OF COLTON
REDEVELOPMENT AGENCY

File: 10(ENV)-4.01

City of Colton
Economic Development Department
Attn: Candace E. Cassel
650 N. La Cadena Drive
Colton, CA 92324

RE: NOTICE OF COMPLETION AND AVAILABILITY OF DRAFT EIR FOR THE WEST VALLEY SPECIFIC PLAN AMENDMENT PROJECT

Dear Ms. Cassel:

Thank you for giving the San Bernardino County Department of Public Works (Department) the opportunity to comment on the above-referenced project. The environmental document was circulated to other Divisions within our Department, and the following are their comments:

Flood Control Planning Division (Omar Gonzalez, P.E., 909-387-8120).

1. Please be advised that tying into an existing San Bernardino County Flood Control District (District) facility will require obtaining a permit from the Flood Control Operations Division, Permit Section.

Traffic Division (Jacob Babico, P.E., Chief, 909-384-7971).

1. Use the existing lane configuration of the intersection of Pepper Avenue/Valley Boulevard. It appears that the report used the old turning lanes and not the improved ones.
2. Use the existing turn volumes to reflect the existing turn lanes at the intersections of Pepper Avenue at Valley Boulevard, I-10 Freeway west and east bound ramps.
3. Use Year 2035 for Future Conditions
4. Correct the lane configuration in Table 10 on page 85 of the Traffic Impact Analysis (TIA) for the intersection of Pepper Avenue/I-10 Freeway east bound ramps for one-lane for northbound traffic and one-lane for northbound right.
5. The intersections of Pepper Avenue/Valley Boulevard and Pepper Avenue/Olive Street are totally within the City of Colton.
6. Correct the following on page 118 of the TIA: Manual of Uniform Traffic Control Devices 2003 California Supplement, dated ~~May 20, 2004~~ September 26, 2006.
7. Provide Project fair share for the following intersections: Cedar Avenue/Valley Boulevard, Cedar Avenue/I-10 Freeway west and east bound ramps and Cedar Avenue/Slover Avenue. Because the City of Colton is not a participant in sharing the construction cost of the interchange of Cedar Avenue/I-10 Freeway, refer to SANBAG Appendix K.

If you have any questions, please contact Frank Molina or me at (909) 387-8109.

Sincerely,

NARESH P. VARMA, P.E., Chief
Environmental Management Division

NVP:FM:mb/CEAQ Comments_Colton_West Valley SP Amend

cc: Frank Molina
GMB/ARI Reading File

Scanned JC

MARK H. UFFER
County Administrative Officer

Board of Supervisors
BRAD MITZELFELT ..... First District
PAUL BIANE ..... Second District
JOSIE GONZALES ..... Fifth District
NEIL DERRY ..... Third District
GARY C. OVITT ..... Fourth District

KINDER MORGAN
ENERGY PARTNERS, L.P.
SFPP, L.P.

SFPP, L.P.
Operating Partnership

November 4, 2009

ENG 4-2-1 (1.7 to 2.2 - ML 001)
File Reference #08-320-2

RECEIVED
NOV 5 2009
1:10pm
CITY OF COLTON
REDEVELOPMENT AGENCY

Ms. Candace E. Cassel
Redevelopment Director
City of Colton
Economic Development Department
650 N. La Cadena Drive
Colton CA 92324

Re: Environmental Impact Report – West Valley Specific Plan Amendment

Dear Ms. Cassel:

This is in reply to the EIR that was received at this office on September 22, 2008, concerning the above referenced site plan in the City of Colton, California.

As previously advised in our reply of May 8, 2008, to the DEIR, Kinder Morgan operates and maintains a 14-inch high pressure refined petroleum products pipeline that generally parallels the Hermosa Avenue and Union Pacific Railroad rights-of-way which lie adjacent to the easterly limits of the development area. Enclosed is a copy of drawing ML-001, sheets 1 and 2 that depict the location of the 14-inch facility.

In the interest of public safety and for pipeline protection, the following provisions must be considered in the design and subsequent construction of improvements near the pipeline:

1. Exact pipeline location can only be determined by pothole at maximum 50 feet intervals. The pothole work must be performed by hand excavation and in the presence of a pipeline representative by contacting KM Area Manager, Mr. B. Toepfer (909) 873-5152 at least two weeks prior to commencement of any work near the pipeline.

2. Adherence to applicable provisions enumerated in the enclosed copy of (a) L-OM200-29 "Guidelines for Design and Construction" relating to proposed projects affecting Kinder Morgan pipelines and (b) copy of Information Bulletin #03-100, issued from the office of the California State Fire Marshal concerning encroachments within and adjacent to pipeline easements.

3. When preliminary project plans have been formulated, based upon the field determination of substructure information, please forward a full sized set of drawings showing the 14-inch pipeline in plan and profile (based on surveyed pothole data) relative to the planned improvements and existing conditions. Upon review of the plans we will provide you with the necessary provisions for pipeline protection when working near this facility.

Please refer to File Reference number 08-320 in future correspondence concerning this project.

Sincerely,

D.R. Quinn
Manager, Pipeline Engineering

T: Quinn/letters/ENG4-2-1/08-320-2/DRQ

Enclosures

cc: Bill Toepher

1100 Town & Country Road Orange, California 92868 714/560-4400 714/560-4601 Fax

INFORMATION BULLETIN
#03-001

Date Issued: June 20, 2003

SUBJECT: ENCROACHMENTS INTO OR ON PIPELINE EASEMENTS

The purpose of this informational bulletin is to delineate the position of the State Fire Marshal regarding encroachments onto the pipeline easements.

Section 51014.6 of the California Government Code states, " (a) Effective January 1, 1987, no person, other than the pipeline operator, shall do any of the following with respect to any pipeline easement: (1) Build, erect, or create a structure or improvement within the pipeline easement or permit the building, erection, or creation thereof. (2) Build, erect, or create a structure, fence, wall, or obstruction adjacent to any pipeline easement which would prevent complete and unimpaired surface access to the easement, or permit the building, erection, or creation thereof. (b) No shrubbery or shielding shall be installed on the pipeline easement which would impair aerial observation of the pipeline easement. This subdivision does not prevent the revegetation of any landscape disturbed within a pipeline easement as a result of construction the pipeline and does not prevent the holder of the underlying fee interest or the holder's tenant from planting and harvesting seasonal agricultural crops on a pipeline easement. (c) This section does not prohibit a pipeline operator from performing any necessary activities within a pipeline easement, including, but not limited to, the construction, replacement, relocation, repair, or operation of the pipeline.

It is the position of the State Fire Marshal that nothing shall encroach into or upon the pipeline easement, which would impede the pipeline operator from complete and unobstructed surface access along the pipeline right of way. Nor shall there be any obstructions, which would shield the pipeline right of way from observation. In the interest of public safety and the protection of the environment, it is imperative that the pipeline operator visually assesses the conditions along the easement to ensure the integrity of the pipeline.

It is the responsibility of the pipeline operator to ensure they have unimpeded surface access and to be able to physically observe all portions of their pipeline rights of way. In cases where this is not possible, the pipeline operator shall inform the State Fire Marshal. The State Fire Marshal shall in conjunction with the pipeline operator resolve the issue.

Questions regarding the issue of pipeline encroachment can be addressed to:

Bob Gorham, Supervising Pipeline Safety Engineer
CDF/State Fire Marshal
Pipeline Safety Division
3950 Paramount Blvd. Suite 210
Lakewood, CA 9012

(562) 497-9100
(562) 497-9104 (fax)
bob.gorham@fire.ca.gov

KINDER MORGAN

Guidelines for Design and Construction near Kinder Morgan Hazardous Liquid Operated Facilities

Name of Company: _____

The list of design, construction and contractor requirements, including but not limited to the following, for the design and installation of foreign utilities or improvements on KM right-of-way (ROW) are not intended nor do they waive or modify any rights KM may have under existing easements or ROW agreements. Reference existing easements and amendments for additional requirements. This list of requirements is applicable for KM facilities on easements only. Encroachments on fee property should be referred to the ROW Department.

Design

- KM shall be provided sufficient prior notice of planned activities involving excavation, blasting, or any type of construction on KM's ROW to determine and resolve any location, grade or encroachment problems and provide protection of our facilities and the public **before** the actual work is to take place.
- Encroaching entity shall provide KM with a set of drawings for review and a set of final construction drawings showing all aspects of the proposed facilities in the vicinity of KM's ROW. The encroaching entity shall also provide a set of as-built drawings showing the proposed facilities in the vicinity of KM's ROW.
- Only facilities shown on drawings reviewed by (Company) will be approved for installation on KM's ROW. All drawing revisions that effect facilities proposed to be placed on KM's ROW must be approved by KM in writing.
- KM shall approve the design of all permanent road crossings.
- Any repair to surface facilities following future pipeline maintenance or repair work by KM will be at the expense of the developer or landowner.
- The depth of cover over the KM pipelines shall not be reduced nor drainage altered without KM's written approval.
- Construction of any permanent structure, building(s) or obstructions within KM pipeline easement is **not** permitted.
- Planting of shrubs and trees is not permitted on KM pipeline easement.
- Irrigation equipment i.e. backflow prevent devices, meters, valves, valve boxes; etc. shall not be located on KM easement.
- Foreign line, gas, water, electric and sewer lines, etc., may cross perpendicular to KM's pipeline within the ROW, provided that a minimum of two (2) feet of vertical clearance is maintained between KM pipeline(s) and the foreign pipeline. Constant line elevations must be maintained across KM's entire ROW width, gravity drain lines are the only exception. Foreign line crossings below the KM pipeline must be evaluated by KM to ensure that a significant length of the KM line is not exposed and unsupported during construction. When installing underground utilities, the last line should be placed beneath all existing lines unless it is impractical or unreasonable to do so. Foreign line crossings above the KM pipeline with less than 2 feet of clearance must be evaluated by KM to ensure that additional support is not necessary to prevent settling on top of the KM hazardous liquids pipeline.
- A foreign pipeline shall cross KM facilities at as near a ninety-degree angle as possible. A foreign pipeline shall not run parallel to KM pipeline within KM easement without written permission of KM.
- The foreign utility should be advised that KM maintains cathodic protection on their pipelines. The foreign utility must coordinate their cathodic protection system with KM's. At the request of KM, foreign utilities shall install (or allow to be installed) cathodic protection test leads at all crossings for the purposes of monitoring cathodic protection. The KM Cathodic Protection (CP) technician and the foreign utility CP technician shall perform post construction CP interference testing. Interference issues shall be resolved by mutual agreement between foreign utility and KM. All costs associated with the correction of cathodic protection problems on KM pipeline as a result of the foreign utility crossing shall be borne by the foreign utility for a period of one year from date the foreign utility is put in service.
- The metallic foreign line shall be coated with a suitable pipe coating for a distance of at least 10 feet on either side of the crossing unless otherwise requested by the KM CP Technician.

- No blasting shall be allowed within 1000 feet of KM's facilities unless blasting notification is given to KM including complete Blasting Plan Data. A pre-blast meeting shall be conducted by the organization responsible for blasting.
  KM shall be indemnified and held harmless from any loss, cost of liability for personal injuries received, death caused or property damage suffered or sustained by any person resulting from any blasting operations undertaken within 500 feet of its facilities. The organization responsible for blasting shall be liable for any and all damages caused to KM's facilities as a result of their activities whether or not KM representatives are present. KM shall have a signed and executed Blasting Indemnification Agreement before authorized permission to blast can be given.

  No blasting shall be allowed within 300 feet of KM's facilities unless blasting notification is given to KM a minimum of one week before blasting. *(note: covered above)* KM shall review and analyze the blasting methods. A written blasting plan shall be provided by the organization responsible for blasting and agreed to in writing by KM in addition to meeting requirements for 500' and 1000' being met above. A written emergency plan shall be provided by the organization responsible for blasting. *(note: covered above)*

- Any contact with any KM facility, pipeline, valve set, etc. shall be reported immediately to KM. If repairs to the pipe are necessary, they will be made and inspected before the section is re-coated and the line is back-filled.

- KM personnel shall install all test leads on KM facilities.

- Burning of trash, brush, etc. is not permitted within the KM ROW.

Insurance Requirements

- All contractors, and their subcontractors, working on Company easements shall maintain the following types of insurance policies and minimum limits of coverage. All insurance certificates carried by Contractor and Grantee shall include the following statement: "Kinder Morgan and its affiliated or subsidiary companies are named as additional insured on all above policies (except Worker's Compensation) and waiver of subrogation in favor of Kinder Morgan and its affiliated or subsidiary companies, their respective directors, officers, agents and employees applies as required by written contract." **Contractor shall furnish Certificates of Insurance evidencing insurance coverage prior to commencement of work and shall provide thirty (30) days notice prior to the termination or cancellation of any policy.**

1. Statutory Coverage Workers' Compensation Insurance in accordance with the laws of the states where the work is to be performed. If Contractor performs work on the adjacent on navigable waterways Contractor shall furnish a certificate of insurance showing compliance with the provisions of the Federal Longshoreman's and Harbor Workers' Compensation Law.
2. Employer's Liability Insurance, with limits of not less than **$1,000,000** per occurrence and **$1,000,000** disease each employee.
3. Commercial General Liability Insurance with a combined single limit of not less than **$2,000,000** per occurrence and in the aggregate. All policies shall include coverage for blanket contractual liability assumed.
4. Comprehensive Automobile Liability Insurance with a combined single limit of not less than **$1,000,000.** If necessary, the policy shall be endorsed to provide contractual liability coverage.
5. If necessary Comprehensive Aircraft Liability Insurance with combined bodily injury, including passengers, and property damage liability single limits of not less than **$5,000,000** each occurrence.
6. Contractor's Pollution Liability Insurance this coverage shall be maintained in force for the full period of this agreement with available limits of not less then **$2,000,000** per occurrence.
7. Pollution Legal Liability Insurance this coverage must be maintained in a minimum amount of **$5,000,000** per occurrence.

- AC Electrical lines must be installed in conduit and properly insulated.
- DOT approved pipeline markers shall be installed so as to indicate the route of the foreign pipeline across the KM ROW.
- No power poles, light standards, etc. shall be installed on KM easement
- No pipeline may be located within 50 feet (15 meters) of any private dwelling, or any industrial building or place of public assembly in which persons work, congregate, or assemble.

Construction

- Contractors shall be advised of KM's requirements and be contractually obligated to comply.
- The continued integrity of KM's pipelines and the safety of all individuals in the area of proposed work near KM's facilities are of the utmost importance. Therefore, contractor must meet with KM representatives prior to construction to provide and receive notification listings for appropriate area operations and emergency personnel. **KM's on-site representative will require discontinuation of any work that, in his opinion, endangers the operations or safety of personnel, pipelines or facilities.**
- The Contractor must expose all KM pipelines prior to crossing to determine the exact alignment and depth of the lines. A KM representative must be present. In the event of parallel lines, only one pipeline can be exposed at a time.
- KM will not allow pipelines to remain exposed overnight without consent of KM designated representative. Contractor may be required to backfill pipelines at the end of each day.
- A KM representative shall do all line locating. A KM representative shall be present for hydraulic excavation. The use of probing rods for pipeline locating shall be performed by KM representatives only, to prevent unnecessary damage to the pipeline coating.
- Notification shall be given to KM at least 72 hours before start of construction. A schedule of activities for the duration of the project must be made available at that time to facilitate the scheduling of Kinder Morgan, Inc.'s work site representative. Any Contractor schedule changes shall be provided to Kinder Morgan, Inc. immediately.
- Heavy equipment will not be allowed to operate directly over KM pipelines or in KM ROW unless written approval is obtained from (Company). Heavy equipment shall only be allowed to cross KM pipelines at locations designated by Kinder Morgan, Inc. Contractor shall comply with all precautionary measures required by KM to protect its pipelines. When inclement weather exists, provisions must be made to compensate for soil displacement due to subsidence of tires. Equipment excavating within ten (10) feet of KM Pipelines will have a plate guard installed over the teeth to protect the pipeline.
- Excavating or grading which might result in erosion or which could render the KM ROW inaccessible shall not be permitted unless the contractor/developer/owner agrees to restore the area to its original condition and provide protection to KM's facility.
- A KM representative shall be on-site to observe any construction activities within ten (10) feet of a KM pipeline or aboveground appurtenance. The contractor **shall not** work within this distance without a KM representative being on site. Only hand excavation shall be permitted within two (2) feet of KM pipelines, valves and fittings unless State requirements are more stringent. However, proceed with extreme caution when within three (3) feet of the pipe.
- A KM representative will monitor construction activity within 25 feet of KM facilities during and after the activities to verify the integrity of the pipeline and to ensure the scope and conditions agreed to have not changed. Monitoring means to conduct site inspections on a pre-determined frequency based on items such as: scope of work, duration of expected excavator work, type of equipment, potential impact on pipeline, complexity of work and/or number of excavators involved.
- Ripping is only allowed when the position of the pipe is known and not within ten (10) feet of KM facility unless company representative is present.
- Temporary support of any exposed KM pipeline by Contractor may be necessary if required by KM's on-site representative. Backfill below the exposed lines and 12" above the lines shall be replaced with sand or other selected material as approved by KM's on-site representative and thoroughly compacted in 12" lifts to 95% of standard proctor dry density minimum or as approved by KM's on-site representative. This is to adequately protect against stresses that may be caused by the settling of the pipeline.

RECEIVED
NOV 05 2009
City Clerk's Office

November 4, 2009

Candace E. Cassel
Economic Development Dept
City of Colton
650 N La Cadena Dr
Colton, CA 92324

RE: City of Colton West Valley Specific Plan and EIR

To Whom It May Concern:

I have extensive (forty five years) experience and expertise in the insect fauna of California, with special expertise in *Rhaphiomidas* biology generally, and specific expertise in the DSF. I have a BS and MS, both in entomology from U.C. Berkeley, and U.C. Riverside respectively. On behalf of private clients, conservation groups and resource agencies, I conduct focused surveys, evaluations and assessments of habitat potential for all threatened and endangered insect species of California. I have prepared, and continue to prepare dozens of technical reports on surveys, habitat assessments, biological opinions, restoration and mitigation plans, and habitat conservation plans, as well as formal research publications, dealing with a full range of general entomology, threatened, endangered and sensitive species in southern California. My interest in the Giant flower-loving flies (*Rhaphiomidas*) is also ongoing now for some thirty years, and for the last two decades I have focused research efforts on the biology and ecology of these dune inhabiting flies, with special attention to the Delhi sands flower-loving fly (DSF). I have been observing DSF in the field for ten years, paying particular attention to DSF adult habits and mating behavior. Extensive field observations of adult behavior for several other *Rhaphiomidas* species has further augmented and refined my understanding of *Rhaphiomidas* ecology and biology. Until very recently, nothing was known of the larval biology for any species *Rhaphiomidas* (aside from their existence under the soil surface, and the adult female deposition of eggs a few centimeters under the soil surface). With combined efforts of myself, G. Ballmer, Mike A. Van Dam. M. Van Dam) and I recently recovered several live larvae of *R. trochilus* – for the first time demonstrating the great depth (up to two meters) at which the larvae dwell, their association with particular moisture horizons in the dune sands, and their gross morphology (fully grown larvae of *Rhaphiomidas* had not been previously documented for any species). While Ballmer is undertaking formal morphological studies of larvae, and M. Van Dam pursues systematics research using molecular/DNA methods (which confirmed the identity of the larvae as *Rhaphiomidas*), I have undertaken the task of making live observations, and in so doing, became the first and only biologist to document the predatory behavior of the larvae, their indeterminant development, and the high motility of larvae through the soil column. Pupation biology, also long unknown, was finally elucidated when I undertook field studies on *R. acton* in the Mojave desert, demonstrating that it is the larva that migrates to the soil surface to pupate and then await impending emergence as an adult (larva themselves not pupating at depth and migrating to surface as a pupa as previously hypothesized). I am also the only

biologist to excavate live *Rhaphiomidas* pupae in the field and achieve successful adult emergence in the laboratory. I am currently certified and permitted by the USFWS to survey for all endangered insect species of southern California, specifically including the, DSF. Finally, Ballmer and I, (with enlisted help of R. Mattoni and T. McGill) have developed a DSF habitat rating system recognized by the USFWS, and employed for analysis in the EIR for the City of Colton – West Valley Specific Plan.

I have reviewed the of the City of Colton – West Valley Specific Plan (WVSP), and the associated Environmental Impact Report (EIR). It is my professional opinion that the proposed WVSP – formerly known to me as the "Superblock development" will cause such serious loss of key populations and existing habitat for the Delhi Sands Flower-loving fly (DSF), that future (successful) conservation will be precluded and viability of the DSF as a species will be in grave jeopardy and doubt. The EIR presents two mitigation options (I list them below), neither of which appear to me to be even remotely satisfactory for any realistic hope of viable, long term conservation for the DSF.

Over the past year or two, Greg Ballmer and I have been consulted by EHL, the City of Colton, and Mr. Tom McGill (preparing a HCP) with respect to planning and potential mitigation for the Superblock. At all times, the question was always framed as "what conservation configuration would be best *IF* the Superblock is developed". Under that constraint, we (Greg Ballmer and I) always responded that maximal conservation of all remaining DSF population sites and habitat was appropriate, as well as reclamation of habitat by removal of existing developments to maximize a conservation area we envisioned as including the "hospital" conservation site, undeveloped portions of the Colton Cemetery north of West C street, and all lands between Meridian street and Hermosa Avenue (with exception of the high school campus at the southern end of Hermosa Avenue). We further proposed removal of all existing homes, offices and drives (down to native soils) on the south side of C street, and removal same on west side of Hermosa Avenue. We proposed that restoration efforts be implemented for these areas as well, with the stipulation that development of the "Superblock" (WVSP) development should not be undertaken until satisfactory DSF populations had been established on the restored conservation area. Although we promulgated on these various conservation strategies, they were always developed under the framework or constraint of total DSF habitat loss on the "Superblock" (WVSP) footprint (all DSF habitat west of Pepper Street and south of San Bernardino Avenue), a condition which I now consider, and have always considered, to have grave consequences for any reasonable chance at successful, long term DSF conservation with DSF population viability. Even with all of those mitigation measures in place, and even if these were combined with preservation of all DSF habitat south of Hwy 10, by overarching conclusion remains the same. Superblock (WVSP) is incompatible with any realistic future viability for DSF.

For this communication, I provide some highlights of, and factors behind, my reasoning (not in any particular order) which I consider in the context of my overarching professional experience with *Rhaphiomidas* ecology and biology. All of these items are interlinked and interplay – most prominently with item # 10 below.

and so persistent year to year high numbers are critical to an individual's reproductive success.

f. For reproductive success, given the biological and behavioral limitations, only very high numbers of adults can compensate for the short life span, random mate search, extended flight season, and indeterminant larval biology.

Respectfully Submitted



Ken H. Osborne
6675 Avenue Juan Diaz
Riverside, CA 92509
Euproserpinus@msn.com

Judith Clarke

From: Ken Osborne [euproserpinus@msn.com]
Sent: Wednesday, November 04, 2009 5:04 PM
To: Judith Clarke
Cc: Dan Silver

RECEIVED
NOV 4 2009
5:04 pm
CITY OF COLTON
REDEVELOPMENT AGENCY

Ken H. Osborne
6675 Avenue Juan Diaz
Riverside, CA 92509

November 4, 2009

Candace E. Cassel
Economic Development Dept
City of Colton
650 N La Cadena Dr
Colton, CA 92324

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For this communication, I provide some highlights of, and factors behind, my reasoning (not in any particular order) which I consider in the context of my overarching professional experience with *Rhaphiomidas* ecology and biology. All of these items are interlinked and interplay – most prominently with item # 10 below.

1. The Vulcan Land Bank has150 acres. Approximately 60 of those acres are Unsuitable habitat for DSF and in my opinion will never support DSF. The critically important areas of high density DSF population (where multiple adults may occur on a site simultaneously) exist there in only one or two locations with a total of some 5 or 10 acres.
2. Lands south of the Vulcan Land Bank (also extensive – ca 100 acres) have likewise only a couple of high DSF density locations, and more than 20, acres of very low quality DSF habitat.
3. The WVSP mitigation scenarios leave the Cemetery (important small high density DSF population) unresolved and not formally included.
4. WVSP destroys (or isolates) extensive DSF occupied, high quality habitat, with at least two (ten acres each) critically important high density populations (king is coming and Rialto dune just off site to west).
5. There are grave doubts of whether and how quickly DSF populations may be "restored" or reintroduced to viable status on lands (ie. east of Meridian) now not supporting large, functional populations.
6. New population sites are probably not often, quickly, or easily established by immigration or colonization from populations of high density (due to # 10 below); and in this same vein, sites with

consistently very high density DSF are probably very long established and self perpetuating relicts of what existed long before widespread habitat loss in the last century.

7. Lands slated for mitigation (east of Meridian) do not support any of the critically important *high density* DSF populations.
8. The high density King is Coming DSF population, as associated with the surrounding extensive acreage of high quality DSF habitat, and the similar status of the Rialto dune (just west of the Superblock [WVSP] footprint) represent DSF population components and lands probably critical to long term viability of DSF.
9. Ecological health with high diversity and abundance of insect fauna (usually linked to extensive undisturbed acreage as opposed to limited and disturbed acreage is important to DSF biology due to the general predatory insectivorous habitat of larval DSF (our recent research has shown).
10. *High density* status of DSF populations appears critical to DSF reproductive success (and therefore viability of the populations) because:
    a. Adults find mates by random search (an inefficient mode).
    b. Adults have never demonstrated efficient mate location by use of pheromones, hilltopping, keying to specific microhabitats, or lecking (efficient mate location modes).
    c. Adults have a very short life span (approximately two days), (coupled with inefficient mate location likely to lead to failures in mate location when populations are of low density).
    d. Adults emerge over a long seasonal period from early July to mid September (again, exacerbating with the low mate location efficiency and short lifespan).
    e. Larval biology is indeterminant – meaning that individual larvae may persist for many years before finally emerging as adult (our recent research shows) and so persistent year to year high numbers are critical to an individual's reproductive success.
    f. For reproductive success, given the biological and behavioral limitations, only very high numbers of adults can compensate for the short life span, random mate search, extended flight season, and indeterminant larval biology.

Respectfully Submitted

Ken H. Osborne

RIALTO UNIFIED SCHOOL DISTRICT

182 East Walnut Avenue Rialto, California 92376-3598 Telephone (909) 820-7700 FAX (909) 873-2489

BOARD OF EDUCATION

Joseph Ayala

Joanne T. Gilbert

John R. Kazalunas, Ed.D.

Joseph W. Martinez

Michael G. Ridgway

JOSEPH G. DAVIS, Ed. D.
Deputy Superintendent
Business Services

October 30, 2009

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NOV 4 2009

CITY OF COLTON
REDEVELOPMENT AGENCY

City of Colton Economic Development Department
Attn: Candace Cassel
659 North La Cadena Dr.
Colton, CA 92324

RE: West Valley Specific Plan-DEIR September 2009

Dear Ms. Cassel:

We have reviewed the (DEIR) as described above and are stating that the Rialto Unified School District is directly impacted by this project as 260-304 acres of the proposed plan lies within the RUSD Boundaries.

The projected 1,293 dwelling units would produce 500 elementary students, 194 middle school students, and 321 high school students yielding 1,016 K-12 students within the Rialto Unified School District.

LAND USE PLAN-CONCEPTUAL

The 11.4 acre school site (PA 6) placed in this plan is located OUTSIDE THE SCOPE OF THE PROJECT in the City of Rialto. Therefore the 16.91 acres (PA-36) Delhi-sands flower-loving fly habitat does not mitigate a portion of the school site that is located in the City of Rialto. At this point in time, there is no mitigation in place for the 11.4 acres.

This plan is unacceptable to the Rialto Unified School District. The entire 16.21 acres dedicated for the school site must be included within the scope of the West Valley Specific Plan. Locating the site within the specific plan would provide better placement of the school in regards to traffic circulation and the overall safety of the students walking to and from school.

To date two (2) letters dated May 8, 2008 and September 18, 2008 have been submitted in response to the conceptual land use plan. These comments are noted in WVSPA-DEIR-September 2009 Section2: Executive Summary-Project Description 2.2.2.

LAND USE PLAN-OPTION A

Under this plan, the entire 14.8 K-8 school site (PA 8) is encompassed within the scope of the project, therefore, fully mitigated by (PA-36) Delhi-sands flower-loving fly habitat. This option is acceptable to the Rialto Unified School District. This Land Use Plan meets the criteria of positioning the entire school site within one jurisdiction and is mitigated by the Habitat Conservation Plan (HCP).

The Rialto Unified School District requests to be notified in writing in advance of any and all public hearings on this development. The Rialto Unified School district is empowered to collect all Mitigation Fees pursuant to Board of Education Resolution No. 08-09-68. The fee must be paid prior to the issuance of any building permits. Upon payment of fees, a Certificate of Compliance will be issued.

Thank you in advance for any further notifications and correspondence.

If you have any questions, please call 909.421.7555.

Respectfully,

Anna Ulibarri

Anna Ulibarri, Director
Facilities Planning

AU/kp