City of Colton
ELECTRIC UTILITY

CITY OF COLTON
TREE REBATE PROGRAM ANALYSIS

Dates covered by plan: 2015-2020

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Executive Summary

This document provides an overall framework for managing Colton's urban and natural forest resources. Using the inventory data collected and employing standard urban forestry principles, the Colton Electric Utility Department has developed a strategy for reducing residential power consumption. The major portions of this document clarifies general goals and policies as they relate to a community forest management plan and are described below.

- Urban forest environmental impacts
- Urban forest benefits
- Technical guides for urban forest management
- Method of evaluating urban forest benefits
- Tree Rebate management plan

Vision

Colton's urban forest, an equal part of the community's infrastructure, contributes to the general welfare of our community by reducing energy costs, increasing property value, beautifying all neighborhoods, and projecting an image of quality to visitors and prospective businesses.

Introduction

Overview

Historical context

The City of Colton was formally founded in 1875 and incorporated in 1887 but its history goes back to the 1770's when several explorers from Mexico searched routes from Sonar, Mexico to Monterey, bringing the first Europeans to the Colton area. Prior to this time, the area was inhabited by the Gua-chama, Serannos and San Gorgionio Indians.

By 1840 Colton was part of two large privately owned ranchos, the Jurupa and the San Bernardino Ranchos. The southwest section of Colton is referred to as Agua Mansa ("Gentle Waters"); the area settled by New Mexico Pioneers in 1842.

The town of Colton was laid out when the Southern Pacific Railway was constructed through the valley on its way eastward from Los Angeles in 1875. Colton was named for Civil War General David Colton who was also vice President of Southern Pacific Railroad Company.

Colton was incorporated July 111, 1887 when 119 of 176 citizens voted in favor of incorporation. Nicolas P. Earp, father of the "Earp Brothers", was appointed Colton's recorder. The Nicholas Porter Earp family settled in Colton in 1877; Nicholas was elected to the position of Recorder in 1887. The same year, Virgil Earp was elected Colton's first Marshal and lived with his wife Allie in a house at 528 W. H. Street which still stands today. Brother Morgan Earp is buried in Hermosa Cemetery.

On October 16, 1889, Colton voted $12,000 in bonds for the erection of a City Hall completed in 1890. The first meeting in City Hall was convened September 1, 1890.

Through the next century, citrus groves were bought and sold, the railroads and road systems grew to accommodate the growth, business grew and did the city.

Urban Forest Environmental Impacts

An urban forest is the complex system of trees and smaller plants, wildlife, associated organisms, soil, water, air and people in and around a city. It surrounds us and impacts the quality of our daily lives. Urban forests provides environmental, psychological, and economic benefits ranging from improved air and water quality to savings from decreased heating and cooling costs to aesthetically pleasing neighborhoods and increased resale values[2]. One large residential tree is estimated to produce $4,000 of total economic benefits over its first fifty years, and to increase resale values by 6 to 9%[1]. The aesthetic and inspirational value of a denser tree population in Colton's urban forest is incalculable. Environmental stewardship toward this resource will ensure that current and future residents enjoy all these benefits.

Trees provide a variety of benefits and make cities more comfortable to live in a variety of ways. Some of which are difficult to quantify economically. For example, trees and shrubs can help quieten city noise. Trees also provide important foraging and nesting opportunities for birds and other wildlife[4]. However, it is some instances quantifying the economic benefits is possible. For example, shade provided by trees greatly reduce cooling cost in moderately high climate zones. The fact that a dollar value can be assigned to the impact of a shade tree emphasizes that an urban forest is a key element of an urban infrastructure.

Reference:

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3. Kuo, F. E. 2003. The role of arboriculture in a healthy social ecology. Journal of Arboriculture29:148–155.
4. McPherson, E. G. 2003. A benefit-cost analysis of ten street tree species in Modesto, California,U.S.A. Journal of Arboriculture 29:1-8.
5. Simpson, J.R. and McPherson, E.G. 1996. Potential of tree shade for reducing residential energy use in California. Journal of Arboriculture 22(1): 10-18.

Benefits provided by trees

Trees help save energy

In temperate climates, shade trees are the principle energy savings benefiter due to the shade they provide. Trees in residential yards that shade the windows, roofs, and walls of home can reduce energy needed for cooling by as much as 34%[1]. A phenomenon known as the urban heat land effect occurs during hot summer due to the fact that urbanized areas can be up to 10°F hotter that the surrounding countryside.[2] This is primary reason for this phenomenon is due to that fact that dark materials, such as buildings and pavement, absorb more of the sun's light rays than lighter colored materials. This leads to an increase in the temperature of the surfaces and the air around them.

Another phenomenon that effects the surrounding temperatures is called evapotranspiration.

Evapotranspiration refers to the way that water is evaporated from within plant leaves, exiting through tiny pores in the leaf. As the water evaporates, it cools the leaf and the air around it in much the same way that swamp coolers function. Trees provide a means of combating the urban heat island effect and ultimately reduce the overall summer temperature within urban areas and help reduce energy consumption.

Improve air quality

Trees improve ambient air quality by removing gaseous air pollutants and particulates from the air[5]. Just as trees reduce the urban heat island effect, trees also reduce the formation of photochemical smog. Higher temperatures increases the chemical kinetics of the reactions that form smog and by shades trees lowering the temperature les smog is formed. Although the majority of smog precursors come from moving vehicles, parked cars also emit volatile hydrocarbons and nitrogen oxides into the atmosphere that react to form smog. Cars parked in shade are much cooler and release fewer volatile hydrocarbons and nitrogen oxides into the atmosphere[5].

Other important services trees provide

Tree canopies capture rainfall, moderate storm water runoff and reduce the amount of pollutants that wash off buildings and paved surfaces into creeks and storm drains[6,7]. Tree shade over pavement slows down pavement deterioration[8]. Trees planted along roadways can have a "traffic calming" effect which reduces driving speeds by visually narrowing the road[9]. Tree roots help to

hold soil in place, and tree canopies shield soil from the impact of rain drops, resulting in decreased soil erosion during storms, which improves stream water quality and reduces silt deposits in reservoirs and flood control basins.

Trees provide direct economic benefits

A variety of studies show that trees increase residential property values. People pay more for homes with attractive trees, that are in neighborhoods with attractive trees, or that are near open space areas with trees[10]. A study by researchers in the State of Washington found that consumers perceive business districts with trees to be higher quality than those without trees. Consumers were willing to pay up to 10% more for goods bought in tree-lined business districts[12].

Reference:

1. Simpson, J.R. and McPherson, E.G. 1996. Potential of tree shade for reducing residential energy use in California. Journal of Arboriculture 22(1): 10-18.
2. "Heat Island Effect." *United States Environmental Protection Agency*. N.p., n.d. Web. 15 Jan. 2015. <http://www.epa.gov/heatisland/>.
3. Heisler, G. M. 1986. Energy savings with trees. Journal of Arboriculture 12:113-125.
4. Scott, K.I.; McPherson, E.G.; Simpson, J.R. 1998. Air pollutant uptake by Sacramento's urban forest. Journal of Arboriculture 24:224-234.
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11. Wolf, K. L. 2003a. Retail and urban nature: creating a consumer habitat. Population and Environmental Psychology Bulletin 29:1-6 (reprint of Amsterdam People/Plant Symposium proceedings).

Scope of the plan

Colton's Electric Utility's mission to conserve and sustain energy depends on the improved understanding of dendrology, the study of woody plants, local to the environment of the City of Colton.

Guidelines for tree planting and maintenance

This section contains technical information about tree planting and maintenance.

Tree placement guidelines

Trees occupy space both above and below ground. Tree canopy height and spread at maturity need to be considered when trees are placed into the urban landscape around residential homes. **Figure 1** shows some important clearances to consider when placing trees in the landscape.

Figure 1: Tree should have adequate clearance from structures, above- and below-ground utilities

Species Selection

Trees can serve multiple functions in the landscape. Properly selected and located trees can be used to reduce energy costs in both winter and summer. The list of qualifying trees are the following: (See Appendix for full tree description)

- Chinese Flame
- Sawleaf Zelkova
- Jacaranda
- Chinese Elm
- Crape Myrtle
- Eastern Redbud
- Flowering Evergreen Pear
- Southern Magnolia

- Jacaranda
- Silk Tree
- Trumpet Tree

Tree Planting Method

It is important to understand the conditions in your yard before you plant new trees. Planting without consideration of the eventual size of new trees can lead to problems between trees and existing structures in the long run. Planting large trees where small ones are appropriate can lead to years of headaches and pruning. Planning for the mature size of your trees avoids problems later on. The process below will help you choose the right tree for your property based upon your goals, needs and existing conditions.

The following steps are illustrated to help create a plan

1. **Find North**
   The strongest sunlight comes from the south and the west. Finding north will help you to orient your home, and find the right locations to shade it.

   There are many ways to find north. Crestline and Lytle Creek are to the north of Colton. Alternatively place a rule or stick in the ground at 12 noon. The shadow will point north. You can also use a compass, a map, or the internet.

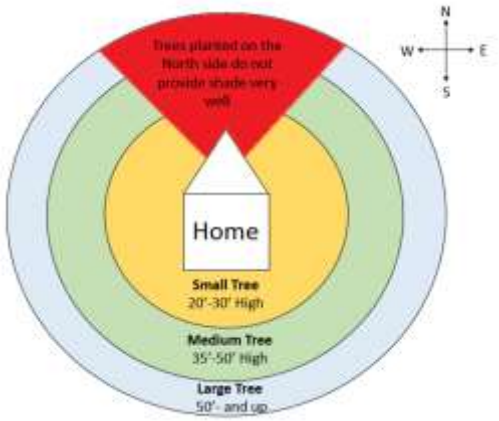

Figure 2: General Recommendations for tree placement

2. **Identify/ Survey Site**
   Tree roots and branches may pose a potential hazard if not sited properly. Tree branches may interfere with overhead power lines. Tree roots may interfere with underground pipes, building foundations, walkways, and fences. Trees should be planted a safe distance from structures, utilities, and paved areas. (See table below) It is highly recommended that a tree is not planted according to the **Table 1.**

Table 1: "No-Plant" Zone

Tree Size	Underground utilities, structures, buildings	Fences & paved areas	Overhead Power Lines
DO NOT PLANT WITHIN			
Small	10 feet	10 feet	10 feet
Medium	25 feet	10 feet	20 feet
Large	35 feet	10 feet	30 feet

3. **Decide Tree Site**
   Locate areas you would like to shade, such as air conditioning units, windows, porches, and patios. Placing trees to the south and west of these areas protects them from the scorching sun rays. Placing trees on the eastern side will provide shade from the morning sun, while placing trees on the western side will provide shade from the afternoon and evening sun.

4. **Tree Size**
   In order to know what kind of tree to choose, you'll need to know what size of tree works best in the spaces where you can plant. Once the tree size has been determined selection of a tree species can be accomplished, based on its appearance, size, and shape.

5. **Planting Supplies**
   Most of tools needed to plant a tree are common yard tools. They include
   - Shovel
   - Garden Hose
   - Hammer
   - Tree stakes – two 5' tall stakes
   - Flexible tree ties-two per tree
   - Wheelbarrow or tarp (optional)

6. **Planting**
   Using a shovel dig a round hole, 2-3 times as wide the size of the tree container and as deep as the container. Leave a pedestal in the center of the hole to ensure the tree's rootball is placed a little higher than the adjacent soil. Discard turf. Rough up the sides of the hole with a shovel so that they are not smooth. Gently remove the tree from its container and gently "tease" the roots out of the rootball. Place the tree in the center of the hole so that the top of the rootball is slighter higher than adjacent ground. Fill the hole with the soil you removed. Firmly pack down the soil. Sprinkle the fertilizer around the tree or push it into the soil outside the rootball, about 3 inches deep. Add 3-4 inches of mulch. Drive two new stakes into the ground outside of rootball. Attached flexible tree ties between the tree and stakes. The ties should not be too tight. Remove any stakes that came with the tree. **Figure 3** shows a proper tree planting.

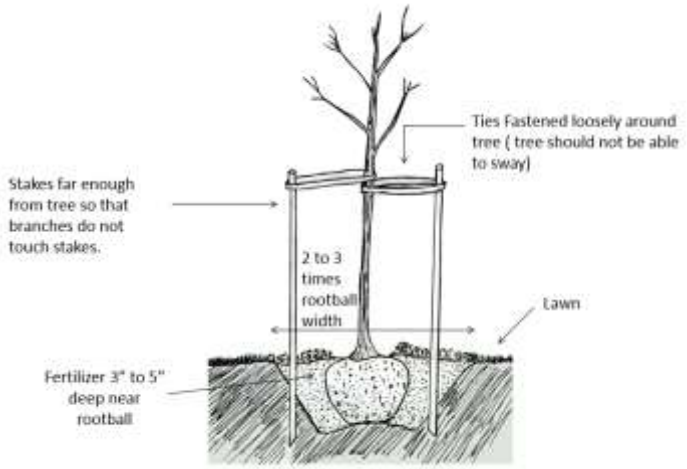

Figure 3

Method of Evaluating Saving Cost and Benefits

Tracking the environmental benefits of planting a shade tree will be accomplished using the Tree Benefit Estimator© provided by Sacramento Municipal Utility District (SMUD). Utilizing this software enables the Electric Utility to estimate the amount of energy savings (KWh saved), capacity savings (KW saved) and carbon and CO_2 sequestration (lbs) resulting from trees planted the City of Colton. **Figure 4** below shows sample simulation of the Tree Benefit Estimator

Shade Trees: Estimated Benefits

Climate Area:	Los Angeles, Calif.
Heating Degree Days (HDD):	1818
Cooling Degree Days (CDD):	614
Latent Enthalpy Hours (LEH):	109
Tree - Common Name:	California Live Oak
Tree - Botanical Name:	Quercus Agrifolia
Tree Size:	Large
Tree Type:	Broadleaf Evergreen
Tree Age:	24
Tree DBH:	24.0
Number of Tree(s):	1
Tree Orientation:	W
Distance from the house:	Near
Summer Rate:	$ 0.17
Winter Rate:	$ 0.17

Benefits From MATURE Tree:												
0.00	261	42	212	$ 84	$ 7	8	2735	10039	98	6030	22128	216
Benefits From Existing Tree of 24.0 DBH (incorporates tree age and tree growth rate):												
0.00	146	22	110	$ 43	$ 4	1	285	1045	80	628	2303	177
Benefits From Program Tree (trees planted by utilities) - utility perspective (incorporates tree growth rate and assumed tree mortality rate):												
0.00	81	12	61	$ 19	$ 2	2	535	1963	19	1179	4327	42

Figure 4: Tree Benefit Estimator

See Appendix for tree benefit estimator of each tree species.

Tree Rebate Management Plan

Residents must select trees from the approved City of Colton tree list in Appendix I and plant them according the guidelines specified. The City of Colton Electric Utility will provide a rebate coupon online at www.ci.colton.ca.us. Residents can obtain up to five rebate coupons and will be reimbursed up to $50 per tree. Once, planted, mail a copy of purchase receipt and coupon to:

Tree Rebate Program
650 N. La Cadena Drive
Colton, CA 92324

Within 14 days of receipt, a specialist will inspect your tree(s) for correct planting location and qualifying species. Following the inspection, your rebate check will be mailed to you within approximately 30 days.

Appendix

Tree Catalog

Small Sized Trees

- **Crape Myrtle**
  Lagerstroemia indica
  Height: 15'-20'
  Width: 15'-20'
  Shape: round
  Showy flower clusters in mid summer. Distinctive smooth bark.

See **Table 2** for of energy savings, capacity savings and carbon and CO_2 sequestration. (Shade Trees: Tree Benefits Estimator, 2015)

Shade Trees: Estimated Benefits

Climate Area:	Los Angeles, Calif.
Heating Degree Days (HDD):	1818
Cooling Degree Days (CDD):	614
Latent Enthalpy Hours (LEH):	109
Tree - Common Name:	Crape Myrtle
Tree - Botanical Name:	Lagerstroemia Indica
Tree Size:	Small
Tree Type:	Deciduous
Tree Age:	14
Tree DBH:	6.0
Number of Tree(s):	1
Tree Orientation:	W
Distance from the house:	Adjacent
Summer Rate:	$ 0.19
Winter Rate:	$ 0.19

KW Saved*	Direct Shading Annual KWh Saved*	Heating Penalty KWh Lost	Indirect Evapotranspiration Benefits	Total Summer Cooling Benefits	Total Winter Heating Penalty	Total Volume (m3)**	Total Carbon Kg**	Stored CO2 Kg**	CO2 Seq/yr Kg**	Total Carbon Lbs**	Stored CO2 Lbs**	CO2 Seq/yr Lbs**
Benefits From MATURE Tree:												
0.00	98	7	74	$ 33	$ 1	2	738	2709	103	1627	5972	228
Benefits From Existing Tree of 6.0 DBH (incorporates tree age and tree growth rate):												
0.00	53	4	40	$ 18	$ 1	0	8	31	3	19	68	6
Benefits From Program Tree (trees planted by utilities) - utility perspective (incorporates tree growth rate and assumed tree mortality rate):												
0.00	31	2	23	$ 8	$ 0	2	675	2478	24	1488	5462	53

Table 2: Crape Myrtle Benefits

- **Eastern Redbud**
  Cercis canadensis
  Height: 8’-20’
  Width: 10’
  Shape: spreading
  Showy flowers in spring

See **Table 3** for of energy savings, capacity savings and carbon and CO_2 sequestration. (Shade Trees: Tree Benefits Estimator, 2015)

Shade Trees: Estimated Benefits

Climate Area:	Los Angeles, Calif.
Heating Degree Days (HDD):	1818
Cooling Degree Days (CDD):	614
Latent Enthalpy Hours (LEH):	109
Tree - Common Name:	Eastern Redbud
Tree - Botanical Name:	Cercis Canadensis
Tree Size:	Small
Tree Type:	Deciduous
Tree Age:	14
Tree DBH:	6.0
Number of Tree(s):	1
Tree Orientation:	W
Distance from the house:	Adjacent
Summer Rate:	$ 0.19
Winter Rate:	$ 0.19

KW Saved*	Direct Shading Annual KWh Saved*	Heating Penalty KWh Cost	Indirect Evapotranspiration Benefits	Total Summer Cooling Benefits	Total Winter Heating Penalty	Total Volume (m3)**	Total Carbon Kg**	Stored CO2 Kg**	CO2 Seq/yr Kg**	Total Carbon Lbs**	Stored CO2 Lbs**	CO2 Seq/yr Lbs**
Benefits From MATURE Tree:												
0.00	98	7	74	$ 33	$ 1	2	738	2709	103	1627	5972	228
Benefits From Existing Tree of 6.0 DBH (incorporates tree age and tree growth rate):												
0.00	53	4	40	$ 18	$ 1	0	8	31	3	19	68	6
Benefits From Program Tree (trees planted by utilities) - utility perspective (incorporates tree growth rate and assumed tree mortality rate):												
0.00	31	2	23	$ 8	$ 0	2	675	2478	24	1488	5462	53

Table 3: Eastern Redbud

- **Flowering Evergreen Pear**
  Pyrus kawakamii
  Height: 15'-25'
  Width: 15'-25'
  Shape: spreading
  Flower clusters in early spring.

See **Table 4** for of energy savings, capacity savings and carbon and CO_2 sequestration. (Shade Trees: Tree Benefits Estimator, 2015)

Shade Trees: Estimated Benefits

Climate Area:	Los Angeles, Calif.
Heating Degree Days (HDD):	1818
Cooling Degree Days (CDD):	614
Latent Enthalpy Hours (LEH):	109
Tree - Common Name:	Evergreen Pear
Tree - Botanical Name:	Pyrus Kawakamii
Tree Size:	Medium
Tree Type:	Deciduous
Tree Age:	7
Tree DBH:	6.0
Number of Tree(s):	1
Tree Orientation:	W
Distance from the house:	Adjacent
Summer Rate:	$ 0.19
Winter Rate:	$ 0.19

KW Saved*	Direct Shading Annual KWh Saved*	Heating Penalty KWh Lost	Indirect Evapotranspiration Benefits	Total Summer Cooling Benefits	Total Winter Heating Penalty	Total Volume (in3)**	Total Carbon Kg**	Stored CO2 Kg**	CO2 Seq/yr Kg**	Total Carbon Lbs**	Stored CO2 Lbs**	CO2 Seq/yr Lbs**
Benefits From MATURE Tree:												
0.00	205	14	154	$ 68	$ 3	6	1895	6954	113	4177	15328	248
Benefits From Existing Tree of 6.0 DBH (incorporates tree age and tree growth rate):												
0.00	45	3	34	$ 15	$ 1	0	51	188	45	113	414	100
Benefits From Program Tree (trees planted by utilities) - utility perspective (incorporates tree growth rate and assumed tree mortality rate):												
0.00	31	2	23	$ 8	$ 0	1	375	1377	13	827	3035	30

Table 4: Evergreen Pear

Medium Sized Trees

- **Chinese Flame Tree**
  Koelreuteria bipinnata
  Height: 20’-40’
  Width: 40’
  Shape: round
  Yellow flowers in summer

See **Table 5** for of energy savings, capacity savings and carbon and CO_2 sequestration. (Shade Trees: Tree Benefits Estimator, 2015)

Shade Trees: Estimated Benefits

Climate Area:	Los Angeles, Calif.
Heating Degree Days (HDD):	1818
Cooling Degree Days (CDD):	614
Latent Enthalpy Hours (LEH):	109
Tree - Common Name:	Golden Rain Tree
Tree - Botanical Name:	Koelreuteria Paniculata
Tree Size:	Medium
Tree Type:	Deciduous
Tree Age:	7
Tree DBH:	6.0
Number of Tree(s):	1
Tree Orientation:	W
Distance from the house:	Adjacent
Summer Rate:	$ 0.19
Winter Rate:	$ 0.19

KW Saved*	Direct Shading Annual KWh Saved*	Heating Penalty KWh Lost	Indirect Evapotranspiration Benefits	Total Summer Cooling Benefits	Total Winter Heating Penalty	Total Volume (m3)**	Total Carbon Kg**	Stored CO2 Kg**	CO2 Seq/yr Kg**	Total Carbon Lbs**	Stored CO2 Lbs**	CO2 Seq/yr Lbs**
Benefits From MATURE Tree:												
0.00	205	14	154	$ 68	$ 3	6	1895	6954	113	4177	15328	248
Benefits From Existing Tree of 6.0 DBH (incorporates tree age and tree growth rate):												
0.00	45	3	34	$ 15	$ 1	0	51	188	45	113	414	100
Benefits From Program Tree (trees planted by utilities) - utility perspective (incorporates tree growth rate and assumed tree mortality rate):												
0.00	31	2	23	$ 8	$ 0	1	375	1377	13	827	3035	30

Table 5: Golden Rain Tree

- **Sawleaf Zelkova**
  Zelkova serrata
  Height: to 40’
  Width: 40’
  Shape: round
  Deciduous
  Leaves have pronounced sawtooth formations.

See **Table 6** for of energy savings, capacity savings and carbon and CO_2 sequestration. (Shade Trees: Tree Benefits Estimator, 2015)

Shade Trees: Estimated Benefits

Climate Area:	Los Angeles, Calif.
Heating Degree Days (HDD):	1818
Cooling Degree Days (CDD):	614
Latent Enthalpy Hours (LEH):	109
Tree - Common Name:	Sawleaf Zelkova
Tree - Botanical Name:	Zelkova Serrata
Tree Size:	Large
Tree Type:	Deciduous
Tree Age:	8
Tree DBH:	6.5
Number of Tree(s):	1
Tree Orientation:	W
Distance from the house:	Adjacent
Summer Rate:	$ 0.19
Winter Rate:	$ 0.19

kW Saved*	Direct Shading Annual KWh Saved*	Heating Penalty KWh Lost	Indirect Evapotranspiration Benefits	Total Summer Cooling Benefits	Total Winter Heating Penalty	Total Volume (m3)**	Total Carbon Kg**	Stored CO2 Kg**	CO2 Seq/yr Kg**	Total Carbon Lbs**	Stored CO2 Lbs**	CO2 Seq/yr Lbs**
Benefits From MATURE Tree:												
0.00	258	18	195	$ 86	$ 3	8	2735	10039	98	6030	22128	216
Benefits From Existing Tree of 6.5 DBH (incorporates tree age and tree growth rate):												
0.00	43	3	32	$ 14	$ 1	0	38	140	30	84	309	66
Benefits From Program Tree (trees planted by utilities) - utility perspective (incorporates tree growth rate and assumed tree mortality rate):												
0.00	29	2	22	$ 8	$ 0	1	219	803	8	482	1770	17

Table 6: Sawleaf Zelkova

- **Jacaranda**
  Jacaranda mimosifolia
  Height: 25’-40’
  Width: 40’+
  Shape: round
  Deciduous or
  semi evergreen.
  Delicate leaves.
  Lavender blossoms
  cover tree in late spring

- **Silk Tree**
  Albizia julibrissin
  Height: to 40’
  Width: 40’
  Shape: spreading
  Deciduous
  Pink and cream
  Feathery flowers.
  Fine leaflets of
  medium green color.

- **Trumpet Tree**
  Tabebuia avellanedae
  Tabebuia chrysotricva
  Height: to 30’
  Width: 40’
  Shape: round
  Briefly deciduous
  T. avellanedae provides showy pink flowers, *T. chrysotricha* provides showy yellow flowers

Large Sized Trees

- **Chinese Elm**
  Ulmus parvifolia
  Height: 40’-60’
  Width: 50’-70’
  Shape: round
  Semi evergreen or Deciduous Arching form. Aggressive surface roots. Can become weedy.

See **Table 7** for of energy savings, capacity savings and carbon and CO_2 sequestration. (Shade Trees: Tree Benefits Estimator, 2015)

Shade Trees: Estimated Benefits

Climate Area:	Los Angeles, Calif.
Heating Degree Days (HDD):	1818
Cooling Degree Days (CDD):	614
Latent Enthalpy Hours (LEH):	109
Tree - Common Name:	Chinese Elm
Tree - Botanical Name:	Ulmus Parviofolia
Tree Size:	Medium
Tree Type:	Deciduous
Tree Age:	7
Tree DBH:	6.0
Number of Tree(s):	1
Tree Orientation:	W
Distance from the house:	Adjacent
Summer Rate:	$ 0.19
Winter Rate:	$ 0.19

KW Saved*	Direct Shading Annual KWh Saved*	Heating Penalty KWh Lost	Indirect Evapotranspiration Benefits	Total Summer Cooling Benefits	Total Winter Heating Penalty	Total Volume (m3)**	Total Carbon Kg**	Stored CO2 Kg**	CO2 Seq/yr Kg**	Total Carbon Lbs**	Stored CO2 Lbs**	CO2 Seq/yr Lbs**
Benefits From MATURE Tree:												
0.00	205	14	154	$ 68	$ 3	6	1895	6954	113	4177	15328	248
Benefits From Existing Tree of 6.0 DBH (incorporates tree age and tree growth rate):												
0.00	45	3	34	$ 15	$ 1	0	51	188	45	113	414	100
Benefits From Program Tree (trees planted by utilities) - utility perspective (incorporates tree growth rate and assumed tree mortality rate):												
0.00	31	2	23	$ 8	$ 0	1	375	1377	13	827	3035	30

Table 7: Chinese Elm Benefits

- **Southern Magnolia**
  Magnolia grandiflora
  Height: 60’
  Width: 40’
  Shape: upright
  Evergreen with
  glossy leaves
  Large, creamy
  and fragrant flowers in summer.

See **Table 8** for of energy savings, capacity savings and carbon and CO_2 sequestration. (Shade Trees: Tree Benefits Estimator, 2015)

Shade Trees: Estimated Benefits

Climate Area:	Los Angeles, Calif.
Heating Degree Days (HDD):	1818
Cooling Degree Days (CDD):	614
Latent Enthalpy Hours (LEH):	109
Tree - Common Name:	Southern Magnolia
Tree - Botanical Name:	Magnolia Grandifolia
Tree Size:	Large
Tree Type:	Broadleaf Evergreen
Tree Age:	7
Tree DBH:	6.0
Number of Tree(s):	1
Tree Orientation:	W
Distance from the house:	Adjacent
Summer Rate:	$ 0.19
Winter Rate:	$ 0.19

KW Saved*	Direct Shading Annual KWh Saved*	Heating Penalty KWh Lost	Indirect Evapotranspiration Benefits	Total Summer Cooling Benefits	Total Winter Heating Penalty	Total Volume (m3)**	Total Carbon Kg**	Stored CO2 Kg**	CO2 Seq/yr Kg**	Total Carbon Lbs**	Stored CO2 Lbs**	CO2 Seq/yr Lbs**
Benefits From MATURE Tree:												
0.00	258	51	195	$ 86	$ 10	8	2735	10039	98	6030	22128	216
Benefits From Existing Tree of 6.0 DBH (incorporates tree age and tree growth rate):												
0.00	30	6	23	$ 10	$ 1	0	20	75	24	45	166	52
Benefits From Program Tree (trees planted by utilities) - utility perspective (incorporates tree growth rate and assumed tree mortality rate):												
0.00	21	4	16	$ 5	$ 1	1	197	724	7	435	1596	16

Table 8: Southern Magnolia

Works Cited

Shade Trees: Tree Benefits Estimator. (2015, February 19). Retrieved from Sacramento Municipal Utility District (SMUD): https://usage.smud.org/treebenefit/Report.aspx