



# EVALUATION, MEASUREMENT & VERIFICATION OF ROSEVILLE ELECTRIC'S SHADE TREE PROGRAM

Prepared for:  
City of Roseville



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**Table of Contents**

- 1 Introduction ..... 1
  - 1.1 Utility Background Information ..... 1
  - 1.2 Energy Efficiency Programs Offered..... 1
  - 1.3 Summary of Claimed Savings..... 3
- 2 Evaluation Plan ..... 4
  - 2.1 Process Evaluation Objectives..... 4
  - 2.2 Impact Evaluation Objectives..... 5
  - 2.3 Evaluation Approach Taken..... 5
  - 2.4 Program Sample Size..... 7
- 3 Process Evaluation Results ..... 8
  - 3.1 Phone Survey Results ..... 8
  - 3.2 Free Ridership ..... 11
  - 3.3 Process Evaluation Summary..... 12
- 4 Impact Evaluation Results ..... 13
  - 4.1 Inputs for On-line Shade Tree Benefits Estimator ..... 13
  - 4.2 Tree Removal Rate ..... 15
  - 4.3 Savings in 2011 from Shade Trees Planted in '04-'06 ..... 16
  - 4.4 Savings Potential per Mature Tree ..... 18
  - 4.5 Realization Rate..... 19
- 5 Summary of Results and Recommendations ..... 21
  - 5.1 Summary of Results..... 21
  - 5.2 Recommendations ..... 22
- 6 Appendix A: Phone Survey Instrument ..... 24

## 1 Introduction

Two legislative bills, SB1037 and AB2021, were signed into law a year apart. SB1037 (signed September 29, 2005) requires that Publically Owned Utilities (POUs), similar to Investor Owned Utilities (IOUs), place cost effective, reliable, and feasible energy efficiency and demand reduction resources at the top of the loading order. Additionally, SB1037 requests an annual report on the POU's programs, expenditures, expected energy savings, and actual energy savings.

Assembly Bill 2021, signed by the Governor a year later (September 29, 2006), reiterated the loading order stated in SB1037 and expanded on the annual report requirements, which must include investment funding, cost-effectiveness methodologies, and an independent evaluation that measures and verifies the energy efficiency savings and reductions in energy demand achieved by the energy efficiency and demand reduction programs. AB2021 additionally requires a report every three years that highlights cost-effective electric potential savings from energy efficiency and established annual targets for electricity energy efficiency and demand reduction over 10 years.

The legislative reports require both an on-going assessment of what is occurring within the programs along with a comparison of how much possible savings is left within the POU service territory. This report is designed to meet these legislative requirements for FY 2010 by performing an EM&V study of Roseville Electric's (RE) Shade Tree Program.

The goals of this EM&V effort are to provide unbiased, objective and independent program evaluations by:

- Utilizing, as best as is feasible and reasonable, the CEC Standards for EM&V Established for Public Owned Utilities (POUs).
- Providing increased level of confidence in conservation program results through transparent protocols that estimate program impacts.
- Providing useful recommendations and feedback to improve on the program.
- Providing assessment of the program effectiveness.
- Providing assessment of the quality of the program tracking data for impact evaluation purposes.

### 1.1 Utility Background Information

Roseville Electric (RE) was established in 1911 as the electric provider for the City of Roseville. It serves more than 53,000 customers, of which almost 90% are residential. Roseville Electric is a summer peaking utility with a peak demand of about 323 MW, much of which comes from extensive use of air conditioning during the summer months.

### 1.2 Energy Efficiency Programs Offered

In 2010, Roseville Electric invested more than \$3 million of public benefit funds in energy efficiency and renewable energy programs. Roseville Electric's programs encourage energy savings by offering rebates to both residential and commercial customers.

#### Summary of Residential Rebate Programs:

- **Air Conditioning and Heat Pump Rebates:** Roseville Electric offers a rebate of up to \$550 for qualified air conditioning systems and \$200 for qualifying heat pumps. A qualifying A/C split system must be at least SEER 15 and a packaged system must be at least SEER 14. A heat pump must have a HSPF of between 8.2 and 8.5 to qualify for a rebate. Roseville Electric is not affiliated with any contractors for installation.
- **Residential Pool Pumps:** A \$300 rebate is provided for variable speed pumps installed in a pool at a single family residence. The pool pump must have a programmable controller unit (built-in or stand alone) to be eligible for rebate. A list of qualifying VSPs is provided on Roseville Electric's website.
- **Appliance Rebates:** A maximum rebate of \$75 is given for installation for high efficiency clothes washer models listed as Tier 2 or 3 on the CEE qualifying product list. A maximum rebate of \$75 is given for installation of Energy Star refrigerators with the proper proof of recycle form for the existing refrigerator.
- **Shade Tree Program:** Roseville Electric offers a \$30 rebate for each qualifying shade tree that is planted correctly in a resident's yard. The tree must be a species that has been noted on the Roseville Electric's list of qualifying trees and it must be planted according to the proper planting directions. Rebates are limited to 6 trees per household.
- **Solar Rebates:** Roseville Electric's solar rebate program provides incentives to customers who install solar systems at their homes.
- **Sunscreens:** A rebate of \$0.75/Sq.Ft. at a \$150 maximum is provided to residential customers who install a sunscreen with a shading coefficient of 0.40 or less (or SHGC of 0.35). These screens must provide shade for windows on the home and must be installed externally on the south, east, or west side of the building.

#### Summary of Commercial Rebate Programs:

- **HVAC Rebates:** Roseville Electric offers rebates to help commercial buildings reduce internal heat loads and update air conditioning equipment with new, high efficiency units. Rebates are offered for packaged AC or heat pumps, cool roofs, window film and Desktop Computer Network Controllers.
- **Lighting Rebates:** Rebates are offered to commercial customers who install a range of high efficiency lighting equipment. These include the removal of inefficient T8 or T12 lights, installation of sensors and installation of various high efficient lighting measures. Pre and post equipment must meet technical requirements outlined in program details to be eligible for rebates.
- **Refrigeration Rebates:** Roseville Electric offers rebates for various refrigeration measures, such as LED lights, anti-sweat heaters, high efficiency motors, door gaskets and strip curtains.
- **Customized Projects:** The custom rebates program is designed to provide energy efficiency rebates to mid-size and large business customers who install peak kW reducing energy efficiency measures, where the project is outside the regular program requirements provided by Roseville Electric. Eligible projects must generate a demand (kW) reduction of at least 20 kW to qualify and demand savings must be between 7 a.m. and 10 p.m. and occur June through September. Rebates are paid up to \$600 for each kilowatt (kW) reduced, depending on level of measurement and verification required on the project.

- **Solar Program:** Roseville Electric rebates commercial customers who apply for and install solar equipment at their business. Customers must follow guidelines for installation to receive full rebates from Roseville Electric.
- **Shade Tree Program:** The Roseville Shade Tree program offers rebates to business properties up to \$30 per qualifying shade tree. Planting shade trees reduces the electric bill and increases the value of your property by improving its appearance, and reducing its environmental impact.

### 1.3 Summary of Claimed Savings

In 2010, Roseville Electric spent a total of \$2,274,381 in program costs, leading to a reduction in peak demand of 2,283 kW and annual energy reductions of 11 million net kWh. Table 1 summarizes the kW, kWh and program costs for all of Roseville Electric’s 2010 energy efficiency programs.

**Table 1: Roseville Electric Claimed E3 Savings FY2010**

Roseville		Resource Savings Summary				Cost Summary			
Program Sector (Used in CEC Report)	Category	Units Installed	Net Demand Savings (kW)	Net Peak kW Savings	Net Annual kWh Savings	Utility Incentives Cost (\$)	Utility Direct Install Cost (\$)	Utility Mktg, EM&V, and Admin Cost (\$)	Total Utility Cost (\$)
<b>Residential</b>									
Appliances	Res Clothes Washers	529	5	5	12,273	\$ 31,079		\$ 821	\$ 31,900
HVAC	Res Cooling	3,084	537	480	655,274	\$ 755,795		\$ 199,152	\$ 954,947
Appliances	Res Dishwashers	48			1,229	\$ 1,200		\$ 109	\$ 1,309
Lighting	Res Lighting	1,009			36,292	\$ 11,533		\$ 1,703	\$ 13,236
Pool Pump	Res Pool Pump	71	54	31	79,520	\$ 34,700		\$ 12,722	\$ 47,422
Refrigeration	Res Refrigeration	1,440	141	141	910,037	\$ 83,650	\$ 8,735	\$ 109,796	\$ 202,181
HVAC	Res Shell	27	5	5	5,062	\$ 2,356		\$ 401	\$ 2,757
<b>Commercial</b>									
HVAC	Non-Res Cooling	144	47	28	140,649	\$ 19,180		\$ 5,458	\$ 24,638
Lighting	Non-Res Lighting	1,450	1,484	1,470	9,145,236	\$ 557,174		\$ 428,912	\$ 986,087
HVAC	Non-Res Shell	95	9	9	12,103	\$ 9,456		\$ 448	\$ 9,904
Total		7,895	2,283	2,169	10,997,675	\$ 1,506,122	8,735	\$ 759,523	\$ 2,274,381

Savings related to the Shade Tree Program are a sub-set of the residential HVAC savings shown in Table 1. Although these savings stem from trees planted from July 2004 to June 2005, they are claimed in 2010 because of the time needed for the trees to fill out sufficiently to provide meaningful shade. Table 2 shows the Shade Tree Program savings claimed in 2010.

**Table 2: Shade Tree Program E3 Savings FY2010**

Roseville		Resource Savings Summary				Cost Summary			
Program Sector (Used in CEC Report)	Category	Units Installed	Net Demand Savings (kW)	Net Peak kW Savings	Net Annual kWh Savings	Utility Incentives Cost (\$)	Utility Direct Install Cost (\$)	Utility Mktg, EM&V, and Admin Cost (\$)	Total Utility Cost (\$)
HVAC	Res Shade Tree	638	30	30	101,059	\$ 19,140		\$ 38,054	\$ 57,194

The Shade Tree Program represents only six percent of the claimed savings for the residential sector and only one percent of the total claimed savings. However, few previous evaluations of Shade Tree Programs exist and uncertainties regarding the savings are significant. This uncertainty was the motivating force behind Roseville Electric selecting the Shade Tree Program for evaluation.

## 2 Evaluation Plan

The Roseville Electric Shade Tree program has been in operation since the early 1990's. The level of claimed energy savings is significant, but these savings are based on previously untested program assumptions; e.g., tree mortality rates and the placement of trees in relation to the building. Roseville Electric's goal with this EM&V study is to provide clarity related to these uncertainties and refine the energy savings estimate associated with trees planted between July 2004 and June 2006. For convenience, for the remainder of this document this period will be referred to as the 2004-2006 program cycle.

Most of the trees provided through RE's program were planted with the assistance of the Roseville Urban Forest Foundation (RUFF). In order to receive rebated trees, residents had to participate in a planting class provided by RUFF. Participants were also required to meet with an arborist who aided in choosing the right type of tree and correct planting location at their home. Currently, RE does not provide this type of structure for the Shade Tree Program. Instead, residents must provide a receipt for their purchase of qualified shade trees to RE in order to receive a rebate of \$30 per tree. The RUFF course and arborist consultation are no longer required. Navigant's evaluation focuses on the program structure from 2004/2006, as the new rebate method does not apply to those individuals who participated in those years.

This report details findings from the evaluation of two primary aspects of the RE Shade Tree Program: process and energy impacts. The remainder of this section details the following points related to these two evaluation components:

- Process evaluation objectives
- Impact evaluation objectives
- Evaluation approach taken
- Program sample size

### 2.1 Process Evaluation Objectives

The process evaluation utilized telephone interviews with program participants from 2005 and 2006. During the review Navigant gathered information ranging from general feedback on the program to specific details concerning the trees the participants received. The purpose was to ask questions that help determine overall program effectiveness as well as net-to-gross ratio. In addition to exploring program process, the telephone survey facilitated the scheduling of on-site visits for the impact evaluation.

A randomized subset of the entire population of participants was used to complete the telephone interviews. Questions were asked regarding program satisfaction and understanding of the value of the shade tree program. The survey instrument was designed to be no more than 10 to 15 minutes long and is included in the appendix of this report.

#### Net-to-Gross Assessment

The NTG ratio is based on free-ridership and spillover. For this program, a free-rider is any participant that would have planted the same tree in the same location regardless of an incentive. Spillover occurs when participation leads to additional, un-incentivized behavior. An example of this is a home owner who plants one tree through the program; then decides to add two more trees later, but does not submit a rebate request for the additional trees. Spillover can also occur when a participant tells another person about the benefits of shade trees and that friend then plants trees without seeking an incentive.

## Net to Gross Ratio Formula

$$\frac{\text{Net Savings}}{\text{Gross Savings}} = \frac{\text{Gross Savings} - (\text{Free Ridership} + \text{Spill Over})}{\text{Gross Savings}}$$

## 2.2 Impact Evaluation Objectives

The primary objective of the impact evaluation portion of this study is to determine energy savings from the program based on actual tree growth and survival rates (*ex post* savings) and to compare these *in-situ* values to the previously forecast (*ex ante*) estimates claimed in the SB1037 annual report. These results are summarized as a realization rate representing actual savings as a percentage of expected savings. To accomplish this, the impact evaluation process verifies measure installations, identifies key energy assumptions, and provides the research necessary to calculate defensible and accurate savings attributable to the program.

To achieve 90% confidence that the results are accurate to within +/- 10% of actual savings, Navigant needed to physically inspect 65 live trees. This verification took place over a three day period in the City of Roseville and provided the necessary information needed to perform the analysis of the Shade Tree Program savings.

Other non-model variables that this review attempted to address include:

- Establish a performance baseline incorporating tree species, orientation and distance from home.
  - Useful for calibrating savings from on-going program participation, which is no longer supervised by RUFF.
- Determine the effect of pruning on shade potential – addressed in section 3.1, Table 7.
- Confirm planting instructions were followed, providing for maximum shade potential and healthy growth of trees.
- Assess impacts on solar electric (PV) installed on residence or on neighbors residence.
  - None of the respondents, or their neighbors, has solar PV arrays.

## 2.3 Evaluation Approach Taken

### On-Site Data Collection

The impact evaluation consisted of on-site verifications to confirm the type, size, and location of the trees that were planted during Roseville’s Shade Tree Program. During the process evaluation phone survey, Navigant screened for those residents who were willing to further participate by allowing a visual inspection of their trees. These on-site audits lasted about 10 to 20 minutes, depending on the level of homeowner interest and discussion. During the on-site visit, Navigant staff collected measurements related to the species, size, placement, and overall health of the program-affiliated tree(s).

To collect these measurements, Navigant staff used the tools listed below. None of these tools are used for directly measuring energy use, but rather, they assist in helping identify the placement of these trees.

- Program application showing sketch of yard and approximate tree placement
- Tree reference guide
- Magnetic compass
- Clinometer (measures angles)

- Tape measure & Laser range finder
- Solar access meter

The tree reference guide provided a visual index of the trees included in Roseville’s program and aided staff in positively identifying the species of trees in the field. The magnetic compass confirmed the geographic orientation shown on the application’s sketch of the yard, necessary in determining solar shading coefficients. Tree growth was assessed by combining measurements from the clinometer, range finder, and a tape measure. Photos of the sky dome were taken using the solar access meters as back-up should a future, more detailed analysis be required.

### **Data Analysis**

After the on-site verifications were completed, an analysis of the results was conducted using a Tree Benefits Estimator<sup>1</sup> developed by Sacramento Municipal Utility District (SMUD). This online calculator estimates the impacts of a utility shade tree program with minimal inputs and a few key assumptions related to tree health and growth.

The American Public Power Association provided a grant to SMUD to help develop the estimator. SMUD worked with the USDA Forest Service, Center for Urban Forest Research in developing the 2008 Urban Forest Project Reporting Protocols for the Green House Gases (GHS) for the California Climate Action Registry. The Tree Benefits Estimator uses a slightly different methodology but the results are in line with the Urban Forest Project Reporting Protocols and staff from the Center for Urban Forest Research; Pacific Southwest Research Station; USDA Forest Service and University of California-Davis has reviewed the Tree Benefits Estimator. Integral to this process are assumptions related to tree growth and survival rates.

The Tree Benefits Estimator provides energy impacts broken out by direct (summer) shading, evapotranspiration, and winter shading. Evapotranspiration (ET) is the process by which water in the soil is absorbed by roots and transpired through the plant’s leaves. This causes the air around a tree to cool through evaporation, indirectly lowering heat gain to the conditioned space.

To tune the calculator results to Roseville Electric’s service area, the component energy impacts mentioned above (summer shading, evapotranspiration, and winter shading) were weighted using the ratio of electric to gas HVAC systems. These fuel type adjustment factors were sourced from the California Residential Appliance Saturation Survey (RASS) under the assumption that homes in Roseville are comparable to those in the surrounding PG&E service area.

These weighted average savings are then used to assess program impacts. This is accomplished by summing calculator generated “Direct Shading Annual kWh Saved” with “Indirect Evapotranspiration Benefits” and multiplying by the percentage of homes with electric air conditioning. “Heating Penalty kWh Lost” is multiplied by the percentage of homes with electric heat and subtracted from the benefits. Final savings are calculated by averaging the results per species.

### **Distinction between the claimed (SB 1037) *Ex Ante* Savings and the *Ex Post* Savings**

Estimates of savings from efficiency measures are typically made both prior to measure installation (*ex ante*) and after program implementation (*ex post*). *Ex post* estimates are considered a more accurate representation of actual impacts because they are generally based on in-situ measurements and other verified data. *Ex Post* savings cited in this report reflect the savings potential calculated by the Shade

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<sup>1</sup> <https://usage.smud.org/treebenefit/calculate.aspx>

Tree Benefit Estimator using tree placement as verified by Navigant staff, with growth indexed by the diameter of the program tree's trunk.

Savings claimed for this measure by RE in their 2010 SB1037 annual report (E3 model) are based on a superseded, prescriptive estimation method that projected savings of 198 kWh per year per mature tree. Per the 2009 instructions for reporting shade tree impacts as a custom measure, *ex ante* savings should have been based on the SMUD Shade Tree Benefits Estimator.

Therefore, this analysis differs from convention in that both *ex ante* and *ex post* savings were calculated after the tree was planted and both are based on outputs from the Shade Tree Benefit Estimator. Distinction between *ex ante* and *ex post* savings occurs because *ex ante* inputs to the calculator use tree placement as reported on the participant application and tree growth defined by tree age. *Ex post* savings are based on inputs founded on verified tree placement and measured tree growth.

## **2.4 Program Sample Size**

In order to perform the phone and on-site surveys, Navigant requested a list of participants who planted trees through the program in 2005 and 2006. From that list, a random sample was generated.

The evaluation goal is to achieve a statistical validity of 90/10 for the trees included in the sample. The sample draw was taken from a population total of 1,253 trees. The size of a 90/10 sample from a population of 1,253 trees is 65. Another of our goals was to insure that our sampled and verified population included at least 60 live trees. Therefore, we over-sampled to insure that both of these goals were met.

The final number of trees verified through on-site visits (existing trees) and through the phone survey, where respondents indicated the trees no longer existed, was 84. These 84 represent a statistical validity of 90/8.75, which is higher than our goal of 90/10. Additionally, the 84 included 65 live trees, which also exceeded our goal of including at least 60 live trees. The on-site verification of 65 live trees represents a 90/10 statistical validity.

### 3 Process Evaluation Results

Navigant staff conducted 37 phone interviews, of which 30 participants agreed to allow on-site verification of tree size, placement and health. These 30 participants subsequently provided Navigant staff with access to 65 rebated trees. The effects of those 65 trees are detailed in the impact evaluation portion of this study – see Section 4.

Of the seven partial interviews, three participants provided feedback related to overall program satisfaction but had lost track of which of the trees in their yard were those incentivized through the program. Four other survey participants reported dead or removed trees. These seven residents were asked general questions regarding the program but could not answer questions specific to their trees.

#### 3.1 Phone Survey Results

As shown in Table 3, when asked about the main reason they chose to participate, most respondents declared that they wished to add trees to their yard for aesthetic reasons. Some were unhappy with the trees the developer had planted initially or wanted to add more trees to their yard. 25% of surveyed respondents mentioned the need for shade as a main participation driver.

**Table 3: Reason for Participating**

Reason for Participating	Number	Percentage
IMPROVE LANDSCAPE/PROPERTY VALUE	16	43%
PROVIDE SHADE	9	24%
REBATED TREES/REPLACEMENT TREES	6	16%
HELP THE ENVIRONMENT	2	5%
PREVIOUS PARTICIPATION IN SMUD PROGRAM <sup>2</sup>	1	3%
OTHER	3	8%

Table 4 illustrates that most respondents have participated in the program only once. Some of these respondents say they only participated once because they have not needed any more trees since their original participation. Many more participants are simply unaware that they could participate in the program more than once.

**Table 4: Participation Amount**

Participated more than once	Number	Percentage
No	31	84%
Yes	6	16%

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<sup>2</sup> One respondent participated in the SMUD shade tree program prior to moving to Roseville and cited this as the primary reason for participating in RE's program.

In terms of overall health, Table 5 shows that all respondents rated their living trees as being in excellent or fair condition, despite often adding that their trees are smaller than they had hoped they'd be by now.

**Table 5: Rating of Tree(s) Health**

Tree(s) Health	Number	Percentage
Excellent	21	57%
Fair	9	24%
Good	0	0%
Poor	0	0%
Tree Removed	7	19%

Table 6 shows that respondents were generally very satisfied with the planting location suggested to them by RUFF staff. The respondent who was not satisfied commented that he had wished the tree had been planted closer to his home, since the tree currently does not shade the house.

**Table 6: Customer Satisfaction with Original Planting Location**

Satisfaction with Planting Location	Number	Percentage
Very Satisfied	24	65%
Somewhat Satisfied	5	14%
Somewhat Dissatisfied	1	3%
Very Dissatisfied	0	0%
Not Applicable	7	19%

Table 7 indicates that, in general, residents take personal responsibility for the care of the shade trees in their yard. Of the respondents who mentioned receiving initial pruning tips through the RE/RUFF class, most indicated that they later further researched how to prune their trees online or in books. Of the respondents that use a gardening service in their yards, most remarked that the gardeners most often suggest against pruning the trees as most are still small and filling out. Of the residents who are pruning their trees, only 25% of them claim to have previous pruning experience.

**Table 7: General Tree Care**

Person Responsible for Tree Care	Number	Percentage
Resident	22	59%
Gardner	8	22%
Not Applicable/No Trees	7	19%

  

Does the Resident Prune the Trees?	Number	Percentage
Yes	16	73%
No	6	27%

Does the Resident Have Pruning Experience?	Number	Percentage
Yes	4	25%
No	12	75%

Does the Gardner Prune the Trees?	Number	Percentage
Yes	3	38%
No	5	63%

Though the majority of the responses shown in Table 8 indicate that the tree did provide some shade, it is interesting to note that 24% of the respondents feel that their trees weren't big enough to provide adequate shade. Most respondents indicated that they are sure when the trees grows a bit bigger, they will better shade their homes and provide a cooling effect. One respondent noted that he noticed a drop in his utility bill since his tree had been providing shade for the bedroom window.

**Table 8: Tree Shading of Home**

Does the Tree Shade the Home?	Number	Percentage
Yes	18	49%
No	4	11%
Tree still growing	8	22%
Unsure/No Trees	7	19%

Does Shading Help Cool Home?	Number	Percentage
Yes	9	50%
No	4	22%
Can't Tell	5	28%

Table 9 shows that 59% of the trees procured through the Shade Tree Program were planted as new additions to the landscaping. Fewer than 1 in 4 participants noted they were replacing larger trees that had to be removed for various reasons, such as being blown over from the area's frequent wind storms. Of the 8 respondents that replaced trees that were lost, 3 of them would have replaced the trees outside of the program. Many individuals expressed satisfaction with the offering of rebated trees through the program structure, stating that the options available with the 2004-2006 program allowed them to replace the trees they had lost.

**Table 9: Original Participant Motivation**

Were the Trees...	Number	Percentage
Replacements	7	19%
New Additions	22	59%
Both	1	3%
Not Applicable/No Trees	7	19%

Table 10 indicates that overall satisfaction is extremely high for the Shade Tree Program. Even respondents whose trees didn't survive stated that the program was well run and great to participate in. Most respondents wanted the program to continue in the way it was run during the program years 2004-

2006 where the trees were given out through the program and the customers were taught how to plant them properly. Participants felt that this personalized attention during the classes and the planting consultation made them feel more confident in their tree planting.

**Table 10: Program Satisfaction**

Overall Customer Satisfaction	Number	Percentage
Very Satisfied	31	84%
Somewhat Satisfied	3	8%
Somewhat Dissatisfied	0	0%
Very Dissatisfied	0	0%
Unsure	3	8%

  

Would You Participate Again?	Number	Percentage
Yes	34	92%
No	0	0%
Unsure	3	8%

Table 11 shows how 25 of the respondents told others about the program and that this led to an additional 21 participants. This cannot technically be classified as spillover as this implies that the 21 additional measure adopters participated in the program rather than buying a tree without an incentive. However, the ratio of 21 additional participants per 37 original applicants shows that participation is fueled by word-of-mouth advertising.

**Table 11: Participant Advertising**

Have you Told Others About the Program?	Number	Percentage
Yes	25	68%
No	5	14%
No Response	7	19%

  

How Many Have You Told?	Number	Percentage
1-5 People	12	48%
6-10 People	5	20%
Can't Remember/Don't Know	8	32%

### 3.2 Free Ridership

Free riders are defined as program participants who would have undertaken an activity, regardless of the presence of a program promoting that activity. In the phone survey, two questions were asked of participants to identify if they were already planning to plant trees before hearing about the program and if their participation in the program changed their original planting intentions. These questions drive at the source of free-ridership and the results are provided in Table 12.

**Table 12: Free-Ridership**

<b>Before You Heard About The Program?</b>	<b>Number</b>	<b>Percentage</b>
Already planning to plant trees	19	61%
Decided to plant trees because of program	12	39%
No response given	6	

**Follow up to those “Already planning to plant trees”**

<b>Did Participation Change Where You Were Going to Plant?</b>	<b>Number</b>	<b>Percentage</b>
No	14	74%
Yes	5	26%

It is clear from Table 12 that there is some amount of free-ridership occurring with the Shade Tree Program. Of the surveyed population, 45% (14 of 31 responses) were already planning to plant trees near their home and participation in the Shade Tree Program did not change their minds on where they would plant these trees.

### **3.3 Process Evaluation Summary**

Overall, the phone surveys provided well-rounded feedback from participants about the Shade Tree Program. Navigant staff encountered some difficulty with contacting the sample population due to lack of correct contact information or the resident not being available at the time the calls were made. But, of the individuals who answered the survey call, most were willing to take the phone survey and participate in the on-site verification.

Almost all the participants surveyed confirmed that the structure of the program from 2004 to 2006, where residents received rebated trees and arborist guidance, was a great program and they wish the program was still available in that format today. Many participants stated that they were not aware of the current Shade Tree rebate offering and were curious if they could participate again. Though the rebated tree program design did allow for a greater potential of free-ridership, the arborist class and the direct guidance from RE staff was a benefit to the program because it helped to ensure the trees were correctly planted and nurtured.

At the conclusion of the phone survey, respondents were asked to give suggestions for program improvement. Many respondents relayed that they were satisfied with the program and did not have any suggestions to offer. Of the respondents that did offer their input, most suggested more publicity for the program and its offerings.

A few residents also suggested that Roseville Electric should follow up with participants about 6 months to a year after the initial planting to ensure the tree was planted correctly and was still alive.

## 4 Impact Evaluation Results

Navigant’s quantification of shade tree impacts hinges on two phases of data collection and processing. Primary data was collected through on-site verification. The details from these site visits were then processed using SMUD’s Shade Tree Benefits Estimator. The Shade Tree Benefits Estimator is an on-line calculator that estimates savings per tree based on default assumptions and a minimal selection of inputs. Both of these steps are described in further detail in section 2.3 of this report.

To obtain a sufficiently large sample size and better capture mortality rates, participants from two program years (July 2004-June 2005 and July 2005-June 2006) were combined into a single pool from which a random sample was selected for evaluation. The average savings per tree as determined by this sample of 65 trees was then applied to the total number of trees rebated between July 2004 and June 2005, as reported in the 2010 E3.

### 4.1 Inputs for On-line Shade Tree Benefits Estimator

Key model variables include:

- Tree species
- Age of the tree from the tree planting date
- Number of trees planted
- Climate zone
- Direction the tree faces (for trees planted next to buildings)
- Distance between the tree and the building that is being shaded
- Tree mortality and expected growth rate

Only two of these calculator inputs remained constant over all entries: number of trees (1) and climate area (Sacramento, CA). Number of trees is constant because the results for each tree are calculated individually. Sacramento is a good climate match for Roseville, being located less than 20 miles southwest of Roseville and not separated by any major terrain or geographic features.

Inputs that vary between trees are detailed in the next four sub-sections: orientation - in relation to home; species of tree; growth referenced using either diameter or age; and the distance from conditioned space. See section 2.3 of this report for more information related ex ante vs. ex post impacts. Table 13 shows how inputs are dependent upon which of these impacts is being assessed.

**Table 13: Data Sources for Calculator Inputs**

Calculator Input	Source for Ex Ante Value	Source for Ex Post Value
Tree Species	Application	On-site Observation
Tree Growth	Years Since Planting	Observed Diameter
Orientation	Application	On-site Observation
Distance from House	Application	On-site Observation

#### 4.1.1 Orientation

The nature of solar geometry and shading are such that tree placement relative to a home has very direct bearing on final results. For example, a tree on the north side provides no shade for a home, and hence, limited savings potential. Conversely, trees on the west aspect of a home are more likely to provide shade during the summer system peak load. Ex ante savings are calculated using the tree placement shown on the participant application. Ex post savings are calculated using the tree placement found by Navigant staff during on-site audits.

**Table 14: Verified Aspect of 2004-2006 Program Trees**

<b>Orientation</b>	<b>Count</b>	<b>Percentage</b>
South	24	37%
West	21	32%
East	11	17%
North	9	14%
<b>Total</b>	<b>65</b>	<b>100%</b>

#### 4.1.2 Species

Species of tree is not only important for growth estimates but also for estimating evapotranspiration rates. Although robust, the calculator does not provide a complete list of tree species. Therefore, substitutions were made as follows:

- Trident Maple is used as proxy for Asian Fringe
- Pomegranate is used as proxy for Chaste Tree
- Plum is used as proxy for Peach
- Bechtel Crabapple is used as proxy for Prairifire Crabapple

#### 4.1.3 Tree Size

The on-line tool avoids direct references to a tree’s height by applying a “Growth Factor” multiplier instead. This growth factor is indexed based on either of two inputs: tree age or diameter. For the purposes of this evaluation, ex ante savings are calculated by filling in the tree’s age and allowing the calculator to apply the expected growth profile. Ex post values are calculated using tree diameters measured during on-site audits. Ex post is based on diameter because, of the two options available, diameter is considered to be more directly indicative of actual tree growth in situ.

#### 4.1.4 Distance to Home

The distance between a tree and home is very important to determining shading impacts. The Shade Tree Benefits Estimator requires that this distance be entered into one of four bins. Table 15 details the variance between reported, measured and bin mid-point distances.

**Table 15: Distance to Home - Variance between Measured and Calculator Input**

<b>Distance Bin Used by Calculator</b>	<b>Midpoint of Bin</b>	<b>Avg. Ex Ante Distance in Bin (ft)</b>	<b>Avg. Ex Post Distance in Bin (ft)</b>	<b>Count of Trees in Bin</b>
0 to 15 ft	7.5	11.2	9.4	26
15 to 30 ft	22.5	21.1	21.9	28
30 to 45 ft	37.5	n/a	33.9	7
over 45 ft	63.0	n/a	59.7	4

*Overall average distance between a shade tree and the home is 20.5 feet.*

Ex ante distances shown in Table 15 are based on values from participant applications; the ex post distances are based on measurements taken by Navigant during on-site verification. Assuming<sup>3</sup> savings are based on the midpoint of these bins, then resulting shading coefficient are conservative for 3 of the 4 bins. Only the bin nearest the house has a midpoint closer than the related verified distance. For five year old trees this is a critical distinction, but this discrepancy in the closest distance bin loses importance as the tree matures.

## 4.2 Tree Removal Rate

Table 16 shows that 65 of the 84 trees reviewed are alive and growing. As detailed in section 2.2 of this report, this is sufficient to meet the study’s objective of providing a 90/10 confidence interval for the population of program trees.

Table 16 also provides a breakdown of removal rate by species. The sample was not designed to provide a 90/10 confidence interval at the individual species level , but results at this level of granularity are useful for relative comparisons between species. The removal rate shown reflects trees no longer in place for any of a number of reasons that include:

- pre-mature death
- removal based on home-owner whim
- replacement in exchange for another, non-program tree

Where changes in home ownership have caused a tree to become inaccessible, it was removed from the sample altogether.

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<sup>3</sup> A transparent, off-line version of the model behind the SMUD Shade Tree Savings Estimator was requested but is not available.

**Table 16: Sample Size and Mortality Rate**

Species	Sample Size	Alive	Dead/ Removed	% of all Removals	Removals as % of Plantings
Asian Fringe	6	5	1	5%	17%
Bechtel Crabapple	2	2		0%	0%
Chaste tree	8	5	3	16%	38%
Chinese Pistache	2	1	1	5%	50%
Eastern Redbud	3	3		0%	0%
Fuyu Persimmon	3	2	1	5%	33%
Golden Rain Tree	4	3	1	5%	25%
Hedge Maple	4	3	1	5%	25%
Japanese Maple	3	1	2	11%	67%
Japanese White Birch	2	0	2	11%	100%
Krauter's Purpleleaf Plum	8	8		0%	0%
Little Leaf Linden	4	4		0%	0%
peach, Late Alamar	1	1		0%	0%
Prairifire Crabapple	1	1		0%	0%
Red Maple	4	4		0%	0%
Saucer Magnolia	4	4		0%	0%
Thundercloud purple leaf plum	7	6	1	5%	14%
Trident Maple	11	6	5	26%	45%
Tupelo	5	4	1	5%	20%
Willow Oak	2	2		0%	0%
<b>Grand Total</b>	<b>84</b>	<b>65</b>	<b>19</b>	<b>100.0%</b>	<b>22.6%</b>

The 22.6% overall removal rate shown in Table 16 is lower than the 29.8% mortality rate<sup>4</sup> built in to the Shade Tree Benefits Estimator. Therefore, this component of the Estimator's algorithm is conservative relative to the five year old trees from RE's Shade Tree Program. However, these trees have another 25-45 years until they reach full maturity. Therefore, this one data point is considered insufficient to suggest that the curve representing default tree survival rate be adjusted at this time.

### 4.3 Savings in 2011 from Shade Trees Planted in '04-'06

The Shade Tree Benefits Estimator provides annual impacts broken out by summer shading, evapotranspiration, and winter shading. Table 17 shows the relative impact of each of these savings for trees in the verification sample.

<sup>4</sup> 29.8% is the average mortality rate for 5 to 6 year old trees in each of the three size categories used by the calculator.

**Table 17: Component Savings from Survey Group**

Row Labels	Existing Tree, Direct Shading Savings (kWh)	Existing Tree Heating PENALTY (kWh)	Existing Tree Evapotranspiration Savings (kWh)
Asian Fringe	22	8	12
Bechtel Crabapple	0	0	0
Chaste tree	82	11	40
Chinese Pistache	0	0	0
Eastern Redbud	42	2	21
Fuyu Persimmon	0	0	0
Golden Rain Tree	69	5	34
Hedge Maple	101	6	51
Japanese Maple	1	1	0
Japanese White Birch			
Krauter's Purpleleaf Plum	172	24	87
Little Leaf Linden	90	12	45
peach, Late Alamar	0	1	0
Prairifire Crabapple	0	0	0
Red Maple	108	12	54
Saucer Magnolia	22	2	10
Thundercloud purple leaf plum	230	17	115
Trident Maple	119	20	61
Tupelo	28	7	14
Willow Oak	5	2	2
<b>Total per aspect</b>	<b>1,091</b>	<b>130</b>	<b>546</b>
<b>Grand Total</b>			<b>1,507</b>

The results shown in Table 17 are bundled into a gross ex post result only after accounting for the HVAC fuel splits typical of residential construction in the region around Roseville. These fuel type adjustment factors were sourced from the 2009 California Residential Appliance Saturation Survey (RASS) under the assumption that homes in Roseville are comparable to those in PG&E’s service area.

The HVAC fuel splits calculated using data from RASS are:

- 91.4% of residences in RE’s service area have electric cooling<sup>5</sup>
- 15.6% of residences in RE’s service area have electric heating<sup>6</sup>

To tune the calculator results to Roseville Electric’s service area, the cooling related savings of “direct shading” and ET are combined and multiplied by the saturation of air-conditioning. Winter shading impacts are taken as a net penalty and subtracted after multiplying by the saturation of electric HVAC systems.

<sup>5</sup> Based on the question: “What type and how many central air conditioning/cooling system(s) do you have in your home?” Of 1,636 responses, 136 said “none” and another 56 did not respond.

<sup>6</sup> 660 of 4,243 responses to the question: “What type of heating system do you use to heat this home?”

Table 18 provides the current annual savings for the trees included in the verification sample. Ex ante results are based on the tree's age and the location shown on the participant application. Ex post results are based on verified diameter and location. Values shown in Table 18 reflect collective savings for the observed sample, including trees that were removed.

**Table 18: 2011 Energy Impacts from Survey Group (N=84)**

<b>Tree Species</b>	<b>Sample Size</b>	<b>Ex Ante Savings, Program Trees (kWh/yr)</b>	<b>Ex Post Savings, Existing Trees (kWh/yr)</b>
Asian Fringe	6	235	30
Bechtel Crabapple	2	39	0
Chaste tree	8	120	110
Chinese Pistache	2	4	0
Eastern Redbud	3	76	57
Fuyu Persimmon	3	8	0
Golden Rain Tree	4	133	93
Hedge Maple	4	89	138
Japanese Maple	3	3	1
Japanese White Birch	2	0	0
Krauter's Purpleleaf Plum	8	196	233
Little Leaf Linden	4	136	122
peach, Late Alamar	1	32	0
Prairifire Crabapple	1	0	0
Red Maple	4	145	146
Saucer Magnolia	4	47	29
Thundercloud purple leaf plum	7	340	313
Trident Maple	11	281	161
Tupelo	5	155	37
Willow Oak	2	15	6
<b>Grand Total</b>	<b>84</b>	<b>2,053</b>	<b>1,476</b>

Results shown in Table 18 can be extrapolated to the entire population of trees planted through the Shade Tree Program between 2004 and 2005 by multiplying by the total number of trees planted in those years. According to Roseville Electric's E3, the total number of trees planted between July 2004 and June 2005 is 638. Therefore, total verified savings realized in 2010 from the '04-'05 program trees is 11,210 kWh.

#### **4.4 Savings Potential per Mature Tree**

Table 19 shows projected energy savings per mature tree, accounting for an expected mortality rate of 50%. These savings are also adjusted to account for the saturation of electric HVAC equipment in the region. This is the total savings per tree that Roseville Electric can claim for incentivized shade trees.

**Table 19: Annual Electricity Savings per Mature Tree, by Species**

<b>Tree Species</b>	<b>Count of Living Trees</b>	<b>Ex Post Savings per Mature Tree (kWh/tree)</b>
Red Maple	4	466
Thundercloud purple leaf plum	6	438
Trident Maple	6	246
Little Leaf Linden	4	207
Golden Rain Tree	3	199
Hedge Maple	3	175
Eastern Redbud	3	168
Krauter's Purpleleaf Plum	8	164
Chaste tree	5	89
Saucer Magnolia	4	69
Tupelo	4	65
Asian Fringe	5	53
Willow Oak	2	34
Japanese Maple	1	10
Bechtel Crabapple	2	0
Prairifire Crabapple	1	0
Japanese White Birch	0	0
Chinese Pistache	1	0
Fuyu Persimmon	2	0
peach, Late Alamar	1	-2
<b>Grand Total/Average</b>	<b>65</b>	<b>170</b>

Table 19 shows the average savings per mature tree is 170 kWh per year. When reviewing these results at the species level, it is important to note many of the species shown have very low individual sample sizes. Average savings for strata this small are easily impacted by the results of a single individual. For instance, 10 trees are shown to provide less than 50 kWh in savings per year. This is likely due to the observed tree having been planted on the north side of the home or too far away to provide shade. Trees planted on the east side were found to show low savings, but if the trees are in the southeast position, savings average about 50 kWh/year at maturity. For additional details related to factors influencing savings per tree, review the parameters detailed in the Inputs for On-line Shade Tree Benefits Estimator section of this report.

#### **4.5 Realization Rate**

Table 20 shows the realization rate for the trees covered in Navigant’s on-site verification, once they reach maturity. The ex post savings are adjusted for HVAC fuel shares as previously described, and both ex ante and ex post savings include the default mortality rate applied by the on-line calculator. This is appropriate because tree maturity is not expected until after year 30 (as a minimum) and the calculator mortality rates are considered more reliable for this extended time frame.

**Table 20: Program Realization Rate**

Tree Species	Sample Size	Ex Ante Savings	Ex Post Savings	Realization Rate
		from Mature Trees (kWh)	from Mature Trees (kWh)	
Asian Fringe	6	1,969	263	13%
Bechtel Crabapple	2	267	1	0%
Chaste tree	8	850	445	52%
Chinese Pistache	2	36	0	0%
Eastern Redbud	3	534	505	95%
Fuyu Persimmon	3	41	0	-1%
Golden Rain Tree	4	1,159	598	52%
Hedge Maple	4	743	526	71%
Japanese Maple	3	15	10	66%
Japanese White Birch	2	0	0	-
Krauter's Purpleleaf Plum	8	1,742	1,315	75%
Little Leaf Linden	4	1,165	826	71%
peach, Late Alamar	1	307	-2	-1%
Prairifire Crabapple	1	0	0	-
Red Maple	4	1,780	1,864	105%
Saucer Magnolia	4	316	275	87%
Thundercloud purple leaf plum	7	2,798	2,627	94%
Trident Maple	11	2,426	1,479	61%
Tupelo	5	1,393	259	19%
Willow Oak	2	180	67	37%
<b>Grand Total</b>	<b>84</b>	<b>19,093</b>	<b>11,057</b>	<b>58%</b>

The 58% realization rate reflects overall program performance relative to what the Shade Tree Benefits Estimator projects using tree locations reported on incentive applications and average tree growth rates.

Even though Navigant's survey found tree removal rates lower than expected at year 5-6, overall savings are lower than expected. Factors contributing to this trend include: trees too far from the structure, growth rates less than expected and trees planted on the northern end of homes.

## 5 Summary of Results and Recommendations

### 5.1 Summary of Results

Notable conclusions from the process review:

- Nearly all residents surveyed decided to participate because they wanted to improve their landscape and provide shade for their home and yard.
- Over half the respondents said the trees provide shade for their home.
- Almost all of the trees planted were new additions to the resident's property.
- Overall satisfaction is extremely high with 84% of respondents choosing 'Very Satisfied.'
- Almost all the participants surveyed confirmed that the 2004-'06 structure of the program, including brief training sessions and arborist guidance was of particular value.
- Over 68% of the respondents told others about the Shade Tree Program.
  - Word of mouth advertising led to an additional 2 participants per 3 respondents.
- 92% of respondents said they would participate in the program again.

Notable findings from the impact evaluation include:

- Upon maturity, average savings per participant tree is 170 kWh/year.
- 1 in 4 trees incentivized through the program were removed prior to year 5 (23%).
  - This spot-check removal rate is lower than the 5 average used by the SMUD calculator (29%).
  - The SMUD calculator uses a survival rate at tree maturity (30-50 years) of 50%.
- Overall program realization rate is 58%.
- Free-Ridership: Of the surveyed population, 45% were already planning to plant trees in their yard and participation in the Shade Tree Program did not change their minds on where they would plant these trees.
- Finding no reported spill-over, the free-ridership of 45% drives the overall program Net-to-Gross (NTG) ratio down to 55%.
- Applying the NTG of 55% to the 58% gross realization rate provides a 32% realization rate for the program. ( $55\% * 58\% = 32\%$ )

Other details of note:

- Demand impacts are not available from the Shade Tree Benefits Estimator.
- Establishing a performance baseline for RUFF planted trees can be used to measure future tree plants not supervised by RUFF.
- No shade trees were found that were affecting solar electric (PV) arrays.

**Table 21: Results Overview**

Tree Species	Ex Post Savings			
	Count of Living Trees	per Mature Tree (kWh/tree)	Savings vs. Average for Sample	Removals as % of Plantings
Red Maple	4	466	274%	0%
Thundercloud purple leaf plum	6	438	257%	14%
Trident Maple	6	246	145%	45%
Little Leaf Linden	4	207	121%	0%
Golden Rain Tree	3	199	117%	25%
Hedge Maple	3	175	103%	25%
Eastern Redbud	3	168	99%	0%
Krauter's Purpleleaf Plum	8	164	97%	0%
Chaste tree	5	89	52%	38%
Saucer Magnolia	4	69	40%	0%
Tupelo	4	65	38%	20%
Asian Fringe	5	53	31%	17%
Willow Oak	2	34	20%	0%
Japanese Maple	1	10	6%	67%
Bechtel Crabapple	2	0	0%	0%
Prairifire Crabapple	1	0	0%	0%
Japanese White Birch	0	0	0%	100%
Chinese Pistache	1	0	0%	50%
Fuyu Persimmon	2	0	0%	33%
peach, Late Alamar	1	-2	-1%	0%
<b>Grand Total</b>	<b>65</b>	<b>170</b>	<b>100%</b>	<b>23%</b>

Table 21 provides a comparison of energy savings per tree relative to removal rates for each species. This helps highlight the species most likely to perform well in Roseville’s Service area. Note that only five species have both a savings per tree that meets/exceeds average, and a lower than average removal rate.

The eight species listed in Table 21 as having fewer than 3 data points should not necessarily be ruled out. The lower adoption rate of these trees simply underscores the advantage of compiling data from future program cycles and allowing the program to naturally progress towards species best suited to Roseville.

## 5.2 Recommendations

Overall, the application form provided great insight to the species and placement of trees. However, the distinction of conditioned vs. unconditioned space should be made clear on the application. The EM&V process would become increasingly robust if a database is maintained with species level results and tree placement across multiple program cycles.

Planting trees on the north side provides very minimal energy savings, if any. Planting trees on the east side is dependent on location relative to the mid-point of the home. Trees planted on the east side accrue energy savings, but if an east side tree is planted further south than the mid-point of the home, the

savings are significantly lower. An additional consideration is the location of the tree relative to a neighbor's home. The tree very well may wind up shading a neighbor's house as if it had been planted to the southwest of that nearby home. A similar "neighbor's house" argument could be made for trees planted to the north of a home. This specific consideration was not included in this evaluation effort but could be included in future year evaluation efforts.

Diversity is important and other species should be considered on individual merit, Roseville Electric's service area seems particularly well suited to these 8 species:

- Red Maple
- Thundercloud purple leaf plum
- Little Leaf Linden
- Eastern Redbuds
- Purpleleaf Plum
- Trident Maples
- Golden Rain Trees
- Hedge Maples.

A few residents also suggested that Roseville Electric follow up with participants between 6 months and a year after the initial planting to ensure that the tree was planted correctly survived the initial transplanting. During this check-in, RE staff should review the basics of local soil quality and be willing to answer detailed questions related to watering practices.

The receipt only program model possibly allows for a greater potential of free-ridership since program participation only requires receipt submittal and no other personalized interaction. RE may wish to return to the style of program that offers more guidance to participants in order to maintain and improve overall realization rate. Almost all the participants surveyed confirmed that the 2004-'06 structure of the program, including brief training sessions and arborist guidance was of particular value. However, it was noted that only 40% of the verified trees were in exactly the location noted on the application. Therefore, regardless of which program structure is chosen, any steps that can be taken to ensure more accurate documentation of final tree location will be beneficial to estimating savings potential.

Many participants stated that they were not aware of the current shade tree rebate offering and were curious if they could participate again. Because most participants only planted two to four trees, it is possible for these residents to continue participating until they reach the maximum of 6 trees per residence stipulated by the program guidelines. In addition, given the proven effectiveness of word of mouth advertising for this measure, marketing through social media could provide a very cost effective way of increasing new participation. Of the respondents that offered open-ended input, most suggested more publicity for the program and its offerings.

## 6 Appendix A: Phone Survey Instrument

Roseville Shade Tree Program Survey

(July 2011)

INTRO.

Hello, my name is \_\_\_\_\_ with Navigant Consulting.

Roseville Electric recently sent you a letter to let you know that we would be calling. We are following up with residents who received shade trees through the Roseville Shade Tree program between 2004 and 2006. The information we are collecting will help Roseville Electric evaluate the program and identify ways the program can be improved for the future. Do you have 5 to 10 minutes to answer some questions about these trees?

Option 1: [IF NO TIME TO TALK NOW, CHECK NAME FIELD AND SCHEDULE A CALL BACK]

Option 2: [IF NON-ENGLISH, CODE AS "CONFIRMED NON -ENGLISH SPEAKING" AND END SURVEY]

Option 3: Are you the resident who received the trees? **[If yes, continue...Go to Q1)**

If No,

Option 4: Was the person who received the trees someone else in your household?

**If YES, Are you able to answer questions about the trees? [If yes, continue...Go to Q1)**

[IF NO, get the name of the person to talk to and schedule a time]

Name: \_\_\_\_\_

Callback Date/Time: \_\_\_\_\_

Option 5: Did you move into your home after 2005? **[If after 2005, continue...Skip to Q3.]**

Option 6: [THE RESPONDENT IS STILL UNCERTAIN OR UNCOOPERATIVE. THANK THEM FOR THEIR TIME AND END SURVEY CODE AS DON'T KNOW/UNWILLING]

**Q1. To start off, what was the main reason you chose to participate in the Shade Tree program? [DO NOT READ; CLARIFY AND RECORD ONLY ONE]**

1 - REDUCE ENERGY BILL

2 - IMPROVE LANDSCAPE/PROPERTY VALUE

3 - ASKED BY NEIGHBORS/HELP NEIGHBORHOOD

4 - HELP THE ENVIRONMENT

5 - REDUCE STORMWATER RUNOFF

6 - OTHER, SPECIFY: \_\_\_\_\_

9 - DK/REF

**Q2.** Have you participated more than one time in the Roseville Shade Tree Program?

- 1 - YES
- 2 - NO
- 3 - Don't Remember
- 9 - DK/REF

**Q3.** According to Roseville's planting records, you received [INSERT NAME/NAMES OF TREES]. Is this correct? (If moved in after 2005, phrase second part "Are these trees in your yard?")

- 1 - YES
- 2 - NO
- 3 - Don't Remember Tree(s) Name(s)

**Q3a.** If NOT ----->What types of trees did you receive and plant? (If moved in after 2005, don't ask this)

---

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**Q4.** We understand that the tree(s) and its/their planting location were provided by the Roseville Urban Forest Foundation....

**Q4a)** Which type of tree worked out best in terms of ease of maintenance, and providing good shade?

\_\_\_\_\_ ENTER TREE CODE FROM LIST

99 - DK/REF

**Q4b)** Which type of tree would you have preferred not to have planted, if any?

\_\_\_\_\_ ENTER TREE CODE FROM LIST

99 - DK/REF

**Q5.** {How many of these trees are / Is your tree} still living?

\_\_\_\_\_ NUMBER STILL LIVING (LESS THAN OR EQUAL TO Q3)

99 - DK/REF

**Q6.** In terms of overall health, how would you rate the current condition of the tree(s) you received?

Would you say...

- 1 - excellent,
- 2 - good,
- 3 - fair
- 4 - poor
- 9 - DK/REF

**Q7.**From your planting record, it shows that your tree(s) are planted **[LIST LOCATIONS FROM (Planting record) FORM]**. How satisfied are you with the location(s) chosen? Would you say...

- 1 - Very satisfied,
- 2 - Somewhat satisfied,
- 3 - Somewhat dissatisfied, **OR**
- 4 - Very dissatisfied?
- 9 - DK/REF

**Q7a.** If dissatisfied, why? \_\_\_\_\_

**Q8.**In terms of maintaining the tree(s) after being planted, do you care for the trees yourself or do you use a gardening service?

- 1 - You or another household member--->go to **Q8a**
- 2 - A gardener or professional service----> go to **Q8c**

**Q8a.** [IF RESPONDENT/HOUSEHOLD RESPONSIBLE FOR TREE CARE:]

Do you prune your tree?

- 1 - YES
- 2 - NO
- 9 - DK/REF

**Q8b.**[IF YES:]Do you have any pruning experience? (example – instruction from a professional service).

- 1 - YES
- 2 - NO
- 9 - DK/REF

**Q8c.**[IF GARDENER RESPONSIBLE FOR TREE CARE:]Does your gardener prune the tree(s)?

- 1 - YES
- 2 - NO
- 9 - DK/REF

**Q9.**Does the tree/do the trees provide shade for your home?

- 1 - YES
- 2 - NO
- 9 - DK/REF

**Q9a.**[IF YES:]Do you feel that the tree makes your home more comfortable on hot days?

- 1 - YES
- 2 - NO
- 9 - DK/REF

IF INDIVIDUAL IS ORIGINAL PARTICIPANT, ASK THE FOLLOWING:(If moved in after 2005, skip to appointment setting)

**Q10.** Thinking back to before you heard about this program...

- 1 - Were you already planning to plant trees on your property before hearing about this program, **OR**
- 2 - Did you decide to plant trees on your property as a result of hearing about this program?
- 9 - DK/REF

**Q10a.[IF ALREADY PLANNING TO PLANT TREES:]** Did your participation in the program change where you were originally planning to put the tree(s)?

- 1 - YES
- 2 - NO
- 9 - DK/REF

**Q10b. [IF YES:]** How?

---

**Q10c.** Were the trees you planted replacements for existing trees or were they new additions to your landscaping? / Was the tree you planted a replacement for an existing tree or was it a new addition to your landscaping?}

- 1 - REPLACEMENT(S)
- 2 - NEW ADDITION(S)
- 3 - BOTH VOLUNTEERED
- 9 - DK/REF

**Q11.** Have you or other members of your household told any other people about the Shade Tree Program? (Don't ask if not the original resident)

- 1 - YES
- 2 - NO
- 9 - DK/REF

**Q11a. [IF YES:]** Approximately how many people have you told?

\_\_\_\_\_ PEOPLE

**Q11b. [IF YES:]** Do you know if any participated?

\_\_\_\_\_ PEOPLE

- 2 - NO
- 9 - DK/REF

**Q12.** Overall, how satisfied or dissatisfied are you with the Shade Tree Program? Are you...

- 1 - Very satisfied,
- 2 - Somewhat satisfied,
- 3 - Somewhat dissatisfied, or
- 4 - Very dissatisfied?
- 9 - DK/REF

**Q12a.** If not satisfied, why not?

---

Q13. If you had it to do over again, would you choose to participate in this program?

- 1 - YES
- 2 - NO
- 9 - DK/REF

Q14. What is one suggestion would you offer to improve this program?

[PROBE AND RECORD ONE MAIN RESPONSE]

\_\_\_\_\_

99 - DK/REF

As you may recall from the letter you received from Roseville Electric, part of our evaluation includes an on-site verification of the trees and their locations. This means a Navigant employee will stop by your home and verify the type and location of the trees. The individual will be wearing a City of Roseville contractor badge that includes the city logo and their picture.[DO THIS UNTIL THE APPOINTMENT SLOTS ARE FILLED]

Do you wish to be present when we make our on-site verification visit? \_\_\_\_\_ (Y/N)

[IF YES, MAKE AN APPOINTMENT AND RECORD WHO YOU WILL BE VISITING]

Appointment Date: \_\_\_\_\_

Appointment Time (plus or minus ½ hour): \_\_\_\_\_

Appointment Contact Person: \_\_\_\_\_

[IF THEY SAY YOU CAN STOP BY AND DO THE VERIFICATION WITHOUT THEIR PRESENCE, TELL THEM ON WHAT DATE]

We plan on making our verification visit to your property on: \_\_\_\_\_

Do you have any specific instructions for being around your home, such as an outside pet or a fence to unlock? \_\_\_\_\_(Y/N)

IF YES, INDICATE HERE:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[THANK RESPONDENT; RECORD REMAINING INFORMATION BELOW]

INTERVIEWER NUMBER: \_\_\_\_\_

LEN. [LENGTH OF INTERVIEW IN MINUTES:] \_\_\_\_\_

DAT. [DATE OF INTERVIEW:] \_\_\_\_\_