

EM&V Report: 2015 Conservation Programs

Prepared for:

Truckee Donner Public Utility District

June, 2016

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1. Executive Summary

ADM Associates was contracted to evaluate the energy impacts of Truckee Donner Public Utility District's (TDPUD) 2015 energy efficiency program portfolio. The district implemented 16 energy and 4 water conservation programs with an ex post *gross* impact of 1,406,860 kWh and 148 kW in the 2015 program year. The portfolio net-to-gross ratio is %70. Portfolio Total resource cost was \$0.10 per kWh which resulted in an overall TRC of 1.4. A summary of the portfolio's performance for CY 2015 is provided in Table 1-1 and an overview of the evaluation's findings and recommendations are provided in Sections 1.1 and 1.2.

Table 1-1 Summary of Ex Post Gross Portfolio Performance

Annual Energy Savings [kWh]	Peak Demand Reductions [kW]	Annual Water Savings [MG]	Lifecycle GHG Reductions [Tons]	Total Resource Cost [\$/kWh]
1,406,860	148	13.9	7,423	\$0.10

Our EM&V report is organized into the following sections:

- Section 1 provides the reader an executive summary of the evaluation's findings and recommendations.
- Section 2 describes the general approaches used for the impact evaluation.
- Section 3 details specific EM&V activities, evaluation findings & recommendations, and overall performance for each of TDPUD's residential programs.
- Section 4 details specific EM&V activities, evaluation findings & recommendations, and overall performance for each of TDPUD's commercial programs selected for evaluation.

1.1. Summary of Evaluation Findings

Detailed evaluation findings for specific programs can be found later in this report (Sections 3 and 4). This section provides a summary of the high level findings pertinent to TDPUD's 2015 portfolio of programs.

- **High participant satisfaction.** All programs for which ADM surveyed participants regarding their satisfaction indicated very high levels of satisfaction with the programs. The most common responses were regarding their appreciation of utility staff.
- **LEDs are becoming more important for portfolio.** As LED technologies continue to drop in cost they are becoming a cost effective alternative to CFLs. This year we saw a large increase in LED lighting throughout TDPUD's residential

and commercial programs – both in quantity and their contribution to overall portfolio impacts.

The following table provides gross and net impacts by program:

Table 1-2 Summary of Program Impacts

Program	Gross Impact Estimates			Net Impact Estimates			Total Resource Cost [\$./kWh]
	Energy [kWh]	Demand [kW]	Water [MG]	Energy [kWh]	Demand [kW]	Water [MG]	
Commercial Custom	42,518	5	-	27,322	3	-	\$0.08
Commercial Green Partners LED/CFL	124,801	12	-	58,598	5	-	\$0.08
Commercial Lighting	146,016	22	-	136,093	20	-	\$0.07
Residential Green Partners	43,359	3	-	29,822	2	-	\$0.11
Appliance Rebate	77,345	9	-	60,418	7	-	\$0.07
Residential Energy Survey/RES	121,432	6	0.005	86,217	5	0.003	\$0.18
ESP/INCOME qualified	17,920	1	0.006	17,920	1	0.006	\$0.21
Refrigerator Recycling Rebate	168,330	26	-	104,481	16	-	\$0.05
High Eff. Electric Water Heater Rebate	617	-	-	487	-	-	\$0.12
Building Efficiency Rebates	5,310	13	-	4,029	9	-	\$0.43
Thermal Eff. Window Rebate	230	1	-	230	1	-	\$0.32
Million CFLs	375,885	25	-	258,529	17	-	\$0.05
LED Holiday Light Swap	11,481	-	-	10,448	-	-	\$0.41
Toilet Rebate Program	5,849	1	0.53	5,002	-	0.46	\$0.89
Toilet Exchange Program	9,695	1	0.88	8,726	1	0.79	\$1.05
He Clothes Washer Water Rebate	1,258	-	0.11	855	-	0.08	\$1.69
Misc. Water Measures	129,061	15	2.68	99,377	12	2.07	\$0.06
Residential Lighting Rebate	49,263	3	-	30,363	2	-	\$0.03
Customer Leak Repair Rebate	35,096	4	9.74	27,024	3	7.50	\$0.03
Green Schools Program	35,242	2	-	24,239	2	-	\$0.15
Whole House Electric	6,152	-	-	6,152	-	-	\$0.31
Total	1,406,860	148	14.0	996,331	106	10.9	\$0.10

1.2. Summary of Evaluation Recommendations

Again, detailed recommendations specific to each program can be found within Sections 3 and 4. This section lists high level recommendations identified by this evaluation to improve program implementation in future program years:

- **Look into ECM Fan motors as a potential measure.** Though most homes in Truckee do not have central A/C thanks to very mild summers; residential homes with central

heating see a significant increase in electricity usage during winter months due to Truckee's heating dominated climate. ECM fan motors are a significant efficiency improvement over *standard* shaded pole or split capacitor motors. ADM recommends that TDPUD consider adding efficient furnaces as a measure in their programs noting potential opportunity to partner with Southwest gas on the measure. While more expensive, additional opportunity exists in retrofitting existing motors to ECM motors as well.

- **Consider surveying customers at giveaway events.** Given the potential for bulbs to leak out of PUD territory from giveaways at local events, we recommend that PUD staff survey customers for their electric utility (or location of primary) residence when handing out bulbs. This data can be used to help future events better target PUD customers specifically. Note that if the impact evaluation contract is initiated earlier in the year then some of the evaluation resources can be spent helping to collect this data.
- **Create Prescriptive Lighting Measures.** Simple lighting measures in particular lend themselves to a prescriptive application process. In line with the previous recommendation ADM recommends that TDPUD establish a list of prescriptive lighting offerings with incentive levels set between \$0.10 and \$.20 per kWh saved. Example offerings should include:
 1. Standard T-8 to Super T-8 Fixture Change-outs (Indoor)
 2. T-8 to LED Fixture Change-outs (Indoor)
 3. Fluorescent Fixture De-lamping (Indoor)
 4. Metal Halide to LED Fixture Change-outs (Outdoor)
 5. Screw Based LEDs
 6. Refrigerated Case Lighting
- **Consider Funding a Potential Study.** Currently little is known regarding saturations and/or potentials for energy efficient equipment in TDPUD territory. While the relative lack of program participation seen over the recent few years can be attributed to socio-economic factors, it is also likely that "standard" energy efficiency measures are reaching saturation and additional measures need to be considered. A Saturation/Potential study would provide TDPUD with the information necessary to identify where energy efficiency opportunities currently exist. A list of potential measures to explore are:
 1. Air compressor efficiency/leak repair
 2. Blower motors / process improvements at the waste water treatment plant
 3. TDPUD Utility infrastructure improvements (water pumps, etc.)

Note that the cost of a potential study could be spread across several small municipals if additional municipal utilities need similar information.

2. General Approach to EM&V

In real-time evaluations the various EM&V activities occurring during a program year are used to administer the implementation of the program. Information from the EM&V activities is used to provide real-time feedback to make real-time adjustments in program implementation that will help ensure that program targets are met. The various activities involved in the real-time EM&V effort are as follows:

- QA / QC of program applications / projects
- Tracking and verification of measure installations
- Measurement of savings impacts for measures / projects
- Program evaluation
- Savings impacts
- Program process evaluation
- Cost-effectiveness

Figure 2-1 is a schematic showing how these real-time EM&V activities relate to program planning and implementation. While we are not performing a formal process evaluation in this project, the concurrent nature of this evaluation allowed us to provide real-time commentary on program processes as we worked with TDPUD in the impact evaluations.

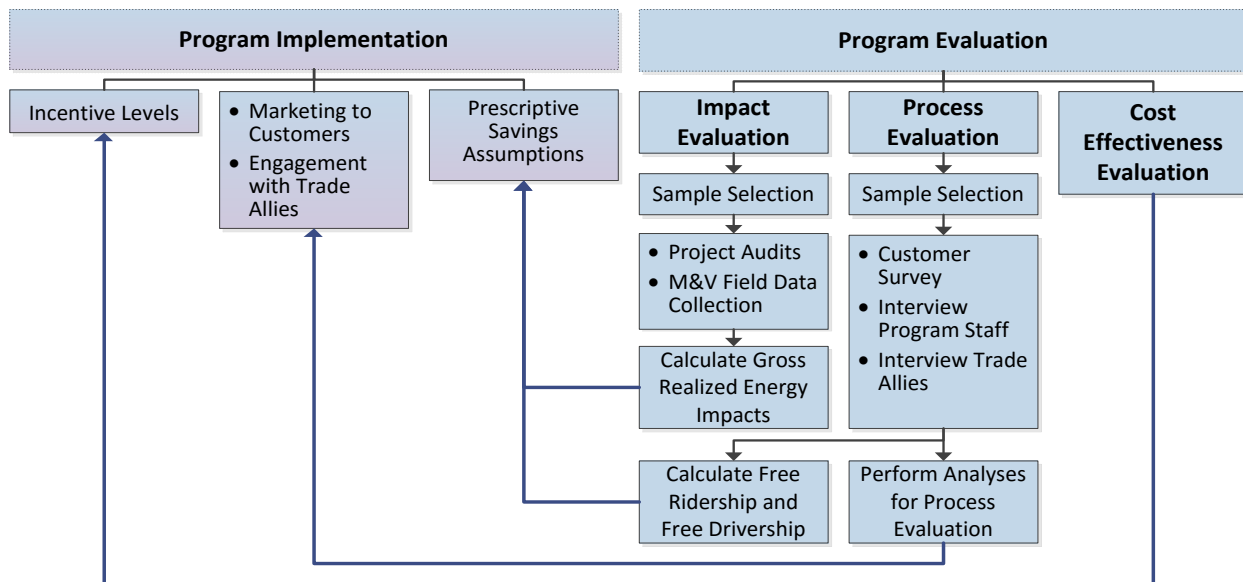


Figure 2-1 Integration of EM&V Activities with Program Planning and Implementation

All evaluation activities were informed by current EM&V industry standards. Additionally we review any literature relevant to the regulatory framework in which the programs were administered. Pertinent literature for this evaluation included:

- National Renewable Energy Laboratory, The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, April 2013.
- Savings Estimation Technical Resource Manual for the California Municipal Utilities Association. Prepared by energy & resource solutions. May 2015.
- American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). Measurement of Energy and Demand Savings, Guideline 14. June 2002.
- California Public Utilities Commission. The California Evaluation Framework. June 2004.
- International Performance Measurement and Verification Protocol. IPMVP Volume I: Concepts and Options for Determining Energy and Water Savings. 2007.
- National Action Plan for Energy Efficiency. Model Energy Efficiency Program Impact Evaluation Guide. Prepared by Steven R. Schiller, Schiller Consulting, Inc. December 2007.

The various activities undertaken for this impact evaluation are shown in Figure 2-2. This section discusses our:

- General approach to gross impact evaluation for TDPUD's programs, and
- General Net-to-gross methodology

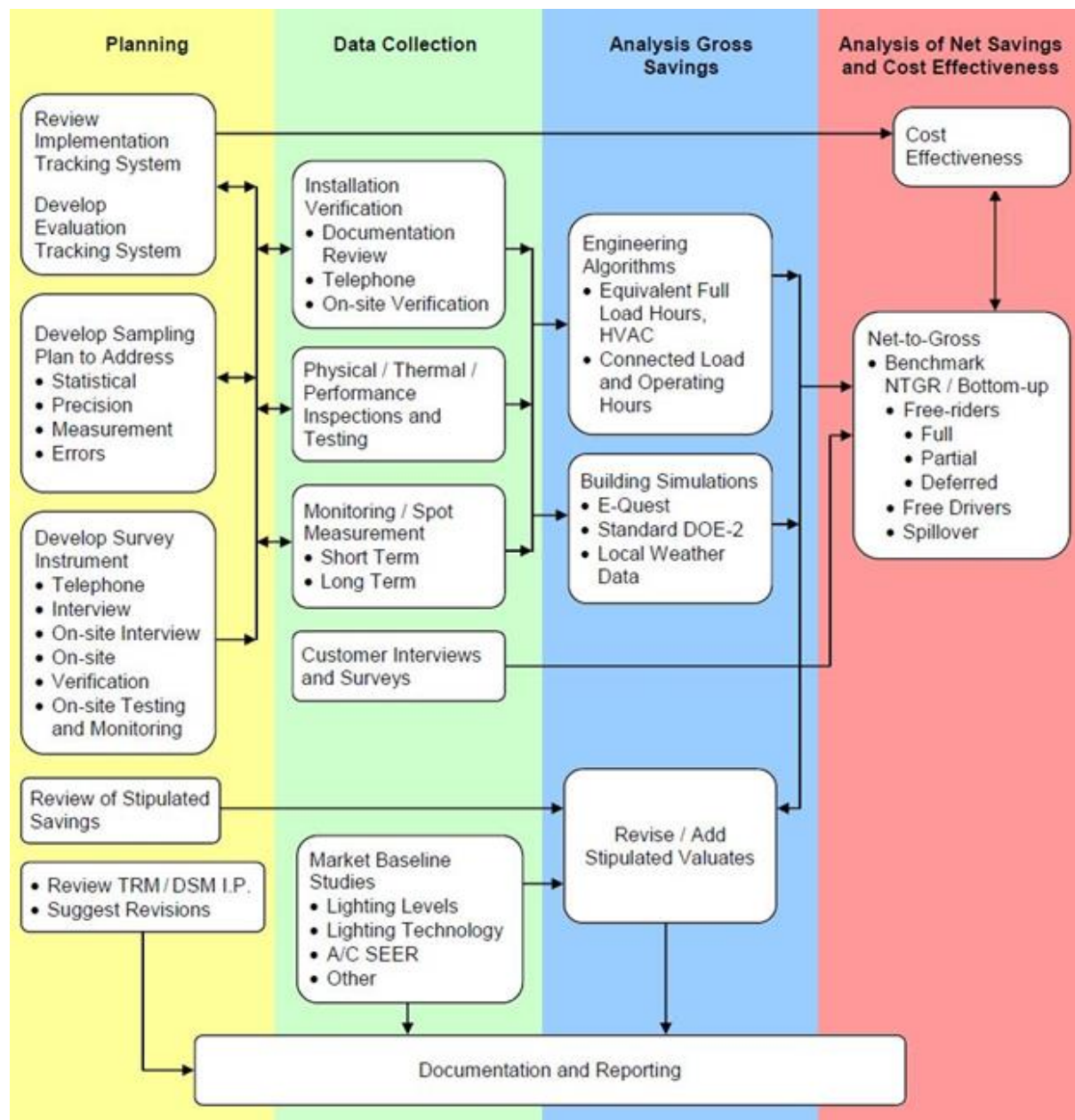


Figure 2-2 Flow Diagram for Impact Evaluation Activities

2.1. Gross Impact Analysis Methods

As delineated in the taxonomy presented in the Model Energy Efficiency Program Impact Evaluation Guide, there are three major approaches to determining gross savings for a program.

- A *deemed savings approach* involves using stipulated savings for energy conservation measures for which savings values are well-known and documented. For example, this approach may be acceptable for lighting retrofits where there is general agreement on the hours of use.

- A *site-specific M&V approach* involves (1) selecting a representative sample of customers or sites that participated in a project; (2) determining the savings for each customer or site in the sample, usually by using one or more of M&V Options defined in the IPMVP; and (3) applying the results of estimating the savings for the sample to the entire population in the project.
- A *large-scale data analysis approach* involves estimating energy savings and demand reductions by applying one or more statistical methods to measured energy consumption utility meter billing data and independent variable data. This approach usually (a) involves analysis of a census of project sites versus a sample and (b) does not involve onsite data collection for model calibration. However, a sample of customers or sites may be selected and visited to confirm that the energy conservation measures were properly installed and are still operating.

ADM examined documentation for each program to identify the types of energy efficiency measures from which savings were expected to be realized and which of these three types of analysis are most appropriate for estimating savings for those measures. We took account of several factors.

- The magnitude of expected savings from program measures affects the choice of savings estimation approach in that analysis of billing data may not be sufficient to detect savings of small magnitude for some measures.
- The number and complexity of the measures and technologies being promoted through a project is a factor in determining the savings estimation approach. For example, if multiple measures can be installed at a single customer site, there may be overlapping and/or interactive effects among the measures. Identifying the effects of individual measures therefore requires using a savings estimation approach that can account for the impact of interrelated measures.
- Costs associated with the different approaches are different and therefore are also considered in choosing the savings estimation approach.

Note that due to limited evaluation resources ADM worked with TDPUD to identify specific evaluation goals for this evaluation cycle. It was determined that a sub-set of the smaller programs would receive a desk review only such that evaluation resources could be spent targeting programs (and measures) representing the majority of energy impacts. Specifically, this year ADM increased survey sample sizes for all programs with lighting measures to focus more on lighting as a measure. *Table 2-1* shows our assignment of the approaches used in the evaluation of each program in TDPUD's 2015 program portfolio.

Table 2-1 List of TDPUD Programs and Proposed Evaluation Methods¹

Program Name	Portfolio Contribution	Gross Impact Method
Commercial Lighting	10%	Site Specific (Option A)
Commercial Green Partners LED/CFL	9%	Deemed (Option A)
Commercial Custom	3%	Site Specific
Million CFLs	27%	Deemed (Option A)
Refrigerator Recycling Rebate	12%	Deemed (Option A)
Misc. Water Measures	9%	Desk Review
Residential Energy Survey (RES)	9%	Deemed (Option A)
Appliance Rebate	5%	Desk Review
Residential Lighting Rebate	3%	Deemed (Option A)
Residential Green Partners	3%	Deemed (Option A)
Customer Leak Repair Rebate	3%	Desk Review
Green Schools Program	2%	Desk Review
Energy Saving Partners (ESP)	1%	Deemed (Option A)
LED Holiday Light Swap	1%	Desk Review
Toilet Exchange Program	1%	Desk Review
Whole House Electric	<1%	Desk Review
Toilet Rebate Program	<1%	Desk Review
Building Efficiency Rebates	<1%	Desk Review
He Clothes Washer Water Rebate	<1%	Desk Review
High Eff. Electric Water Heater Rebate	<1%	Desk Review
Thermal Eff. Window Rebate	<1%	Desk Review

It can be seen in Table 2-1 that a minority of programs account for the majority of portfolio impacts. Consequently, ADM allocated more resources to programs with the largest impacts in order to minimize uncertainty in the overall evaluation results within the available resources. In the remainder of this section we discuss a more detailed application of the EM&V methods used in our analysis of the TDPUD portfolio. Note that specific applications of these methods are discussed for each program in Sections 3 and 4.

¹ Note that “Option A” here refers to International Performance Measurement & Verification Protocols (IPMVP) Option A.

2.1.1. Deemed Savings Approach

For most of the measures, unit-level savings due to installation of the measures are well documented and allow the use of such savings as deemed values from the CMUA TRM. For the evaluation of these programs, we identified appropriate unit-level savings for program measures. For this review, we used information from program documentation as well as from the CMUA TRM, the DEER, the Regional Technical Forum, and measure databases/TRMs from other states. We identified savings calculations and estimates (1) whose methodologies used for calculating savings were appropriate, and (2) whose assumptions are reasonable and appropriate. In reviewing the methodologies for calculating energy savings, we focused on the main factors that determine energy use.

We verified measure installations by reviewing program tracking data and conducting customer surveys for statistically valid samples of projects from the program. When sampling, we focused on (1) projects accounting for a significant portion of estimated savings and (2) projects for which savings estimates seem most uncertain. The sample was selected so that results were representative of the population of projects to $\pm 10\%$ precision at the 90% confidence level.

2.1.2. Site-specific M&V Approach

A site-specific approach involves the following steps:

- Selecting a representative sample of customers or sites that participated in a program;
- Determining the savings for each customer or site in the sample, usually by using one or more of M&V Options defined in the IPMVP; and
- Applying the results of estimating the savings for the sample to the entire population in the program.

The above steps were tailored to each program evaluated in this manner (this accounts for the unique characteristics of each program). With the site-specific approach, we collect important items of data needed for the analysis of gross savings through on-site data collection. Using comprehensive data collection forms, our field personnel collected data from several sources during the on-site visit:

- We first collected data through interviews with the staff of the site. The interview with site staff provides information on occupancy schedules, lighting schedules, ventilation schedules, equipment schedules, operational practices, maintenance practices, and other factors that are associated with energy use at the site.
- We reviewed documents or records at the site. This includes reviewing basic building plans and architectural drawings. These data also include information on

process equipment, HVAC systems and equipment, on lighting and on hot water systems from mechanical, electrical and plumbing plans.

- We visually inspected control settings, lighting levels, inventory of end use appliances and equipment, ventilation rates, building population, occupancy level, and other parameters.

During the on-site visit, we collect additional information about factors that affect energy use by end-users. Data on these factors are needed in order to analyze and to verify the energy savings of rebated measures. Data also are needed that pertain to the present pattern of energy use at a site. We use electricity use data for the site to establish this pattern. We ask facility personnel to sign a waiver form that will allow us to request electric use data from the serving utility for twelve previous months (if available). (We use monthly data over a year in order to establish any seasonal aspects in the pattern of energy use.)

Our field personnel also take photographs of a site and of its electrical and mechanical systems during the on-site visit. Our experience has been that photographs taken during a visit are a highly useful means of verifying the data that are collected.

If appropriate, we conduct monitoring at a sub-sample of the sites selected for the onsite data collection. The sites chosen for monitoring are those sites with projects where there is some uncertainty about the values for important factors that affect the level of savings. For example, we may use monitoring to obtain information on operating hours for some types of lighting measures. To better inform the selection of sites for monitoring, we review any documentation that may have prepared for the sites chosen for the on-site sample. Based on this review, we determine whether monitoring measures at a site will be required to verify savings. The split between certainty and non-certainty sites is determined through the analysis of actual project data.

To verify savings for measures installed at project sites, we use methods that depend on the type of measure. Categories of measures include the following:

- Lighting;
- HVAC;
- Motors;
- VFDs;
- Compressed-Air;
- Refrigeration; and
- Process Improvements.

The general methods used by this evaluation to assess site-level impacts are summarized in Table 2-2:

Table 2-2 Typical Methods to Determine Savings for Custom Measures

Type	Method to Determine Savings
Lighting	ADM's lighting evaluation model, which uses data on wattages before and after installation of measures and hours-of-use data from field monitoring.
HVAC (including packaged units, chillers, cooling towers, controls/EMS)	eQUEST energy simulation model, which automates the analysis of energy use in buildings. eQUEST uses DOE-2 as its analytical engine for estimating HVAC loads and includes a pre-processor that uses billing data for a site to prepare a benchmark for the site.
Motors and VFDs	Measurements of power and run-time obtained through monitoring
Compressed Air Systems	Engineering analysis, with monitored data on load factor and schedule of operation
Refrigeration	Simulations with DOE2.2 refrigeration engineering analysis models and/or engineering analysis using monitored data
Process Improvements	Engineering analysis, with monitored data on load factor and schedule of operation

Activities specified in the Table above produce verified gross savings calculations for each sampled project. ADM developed estimates of program-level gross savings by applying a ratio estimation procedure in which achieved savings rates estimated for the sample projects were applied to the program-level expected savings.

We obtain the primary data needed to estimate savings and peak impacts by making on-site visits to a sample of sites, survey program participants, and/or reviewing program documentation (including invoices, cut-sheets, applications, etc.). The appropriate deployment of monitoring equipment was determined on a project-specific basis as part of the M&V planning for each sampled project.

We use site visits to accomplish two major things. First, our field personnel verify that the energy efficiency measures for which incentives were given were indeed installed, that they were installed correctly, and that they still function properly. Second, they collect the data needed to analyze the energy savings and kW impacts for the installed measures.

- For measures with deemed savings values (e.g., IPMVP Option A, or those for which values are included in a TRM), we make on-site verification visits to confirm the as-installed and used conditions that provide the expected savings. For

projects where most measures have deemed savings values, no IPMVP metering or monitoring assessment was conducted.

- For measures for which deemed savings values are not available, we use site visits to accomplish two major things. First, our field personnel verify that the energy efficiency measures for which incentives were given were indeed installed, that they were installed correctly, and that they still function properly. Second, they collect the data needed to analyze the energy savings and kW impacts for the installed measures.

We have well-developed and tested procedures in place for collecting the data needed for detailed analysis of the energy performance of energy efficiency measures. The focus of our site visit data collection is to obtain appropriate information to analyze the performance of the different types of energy systems at a facility. This includes collecting information on the quantity, sizing, servicing, and scheduling for HVAC, lighting, refrigeration, motors, process and other equipment. We also collect information on the capabilities of building control systems (e.g., whether centralized or distributed, capabilities for control monitoring, automation possibilities, and expansion possibilities).

We have designed and use a standardized form for on-site data collection that ensures that the information needed to analyze energy efficiency measures is collected for each facility visited. Because we have done extensive M&V work for a variety of utility energy efficiency programs, we have a good understanding of the nature of the data that need to be collected during site visits and the procedures to use to collect that data most cost effectively. We extract items of information from the tracking systems that need to be provided to the field staff to facilitate error-free and efficient site visits.

As part of the data collection, we also may conduct monitoring of specific measures, as applicable and where it is feasible. If a site is selected for field monitoring, the field personnel will have all the proper equipment available for installation at the time of the visit. We install the equipment with minimal intrusion on the participant's operation.

2.2. Method of Net Savings Analysis for Each Program

The basic issue in net savings analysis is determining what part of the gross savings, achieved by program participants, can be attributed to the effects of the program. The savings induced by the program are the "net" savings that are attributable to the program.

Net savings may be less than gross savings because of free ridership impacts, which arose to the extent that participants in a program would have adopted energy efficiency measures and achieved the observed energy changes even in the absence of the program. Free riders for a program are defined as those participants that would have installed the same energy efficiency measures without the program.

The goal of the net-to-gross analysis was to estimate the impacts of energy efficiency measures attributable to the energy efficiency programs that were net of free ridership. That is, because the energy savings realized by free riders are not induced by the program, these savings should not be included in the estimates of the program's actual impacts. Without adjustment for free ridership, some savings that would have occurred naturally would be attributed to the program. The measurement of the net impact of the program requires estimation of the marginal effect of the program over and above the "naturally occurring" patterns for installation and use of energy efficient equipment.

ADM employed two methods of Net-to-Gross analysis for the programs implemented by TDPUD. The first method was used on programs for which the evaluation applied a *Deemed* evaluation approach and the second for programs receiving a site specific evaluation approach. These two approaches are discussed in this section.

2.2.1. Net-To-Gross Approach Programs Evaluated using a *Deemed Savings Method*

Rather than apply a binary scoring (0% vs. 100% free-ridership), the Evaluators applied a free-ridership probability to program participants, based upon four factors:

- (1) Financial ability to purchase high efficiency equipment absent the rebate
- (2) Importance of the rebate in the decision-making process
- (3) Prior planning to purchase high efficiency equipment
- (4) Demonstrated behavior in purchasing similar equipment absent a rebate

In this methodology, Part (1) is essentially a gateway value, in that if a participant does not have the financial ability to purchase energy efficient equipment absent a rebate, the other components of free-ridership become moot. As such, if they could not have afforded the high efficiency equipment absent the rebate, free-ridership is scored at 0%. If they did have the financial capability, we then examine the other three components, each contributing an equal scoring of 33% to free-ridership. It should be noted that having financial ability does not necessarily imply free-ridership; it just opens the possibility that other factors could contribute. A participant that was financially able to purchase high efficiency lighting, for example, could still be scored at 0% free-ridership if it is demonstrated that:

- (1) The rebate factored into their decision-making process;
- (2) They did not have prior plans to install high efficiency equipment before learning of the available rebates; and
- (3) They did not demonstrate prior behavior of purchasing similar equipment absent a rebate.

There are other contributing factors to free-ridership, specifically in instances of programs that provide outreach to customers. For example, if in a large commercial retrofit, a sponsoring utility provides assistance in energy efficiency measure recommendation, or in providing cost-benefit analysis of a measure to a business, these could factor into the decision-making in ways that mitigate free-ridership, in that there are cases where a participant did not need a rebate to participate, but was induced to participate by the sponsoring utility's efforts in recommending and/or evaluating energy efficiency measures for them. Additional issues such as this are addressed on a program-by-program basis in methodology sections to follow.

For residential programs, free-ridership is calculated as the average score determined for the sample of participants surveyed. For business programs, a weighted average is taken of verified kWh savings, as the free-ridership scores of high-savers contribute a larger share of the overall free-ridership rate. Once free-ridership is determined, the Evaluators then estimate the Net-to-Gross Ratio (NTGR), calculated as:

$$NTGR = 1 - \% \text{ Free-Ridership}$$

2.2.2. Net-To-Gross Approach for Programs Evaluated using a *Site-Specific Approach*.

Information was collected from a sample of program participants through a customer survey. Based on review of this information, the preponderance of evidence regarding free ridership inclinations was used to attribute a customer's savings to free ridership.

Several criteria were used for determining what portion of a customer's savings for a particular project should be attributed to free ridership. The first criterion was based on the response to the question: "Would you have been financially able to install the equipment or measures without the financial incentive from the energy efficiency program?" If a customer answered "No" to this question, a free ridership score of 0 was assigned to the project. That is, if a customer required financial assistance from the energy efficiency program to undertake a project, then that customer was not deemed a free rider.

For decision makers that indicated that they were able to undertake energy efficiency projects without financial assistance from the program, three factors were analyzed to determine what percentage of savings may be attributed to free ridership. The three factors are:

- Plans and intentions of firm to install a measure even without support from the program
- Influence that the program had on the decision to install a measure
- A firm's previous experience with a measure installed under the program

For each of these factors, binary variables were developed indicating whether or not a participant's behavior showed free ridership. These rules made use of answers to questions on the decision maker survey questionnaire.

The first factor required determining if a participant stated that his or her intention was to install an energy efficiency measure even without the program. The answers to a combination of several questions were used with a set of rules to determine whether a participant's behavior indicates likely free ridership. Two binary variables were constructed to account for customer plans and intentions: one, based on a more restrictive set of criteria that may describe a high likelihood of free ridership, and a second, based on a less restrictive set of criteria that may describe a relatively lower likelihood of free ridership.

The first, more restrictive criteria indicating customer plans and intentions that likely signify free ridership are as follows:

- The respondent answered “yes” to the following two questions: “Did you have plans to install the measure before participating in the program?” and “Would you have gone ahead with this planned installation of the measure even if you had not participated in the energy efficiency program?”
- The respondent answered “definitely would have installed” to the following question: “If the financial incentive from the energy efficiency program not been available, how likely is it that you would have installed [Equipment/Measure] anyway?”
- The respondent answered “did not affect timing of purchase and installation” to the following question: “How did the availability of information and financial incentives through the energy efficiency program affect the timing of your purchase and installation of [Equipment/Measure]?”
- The respondent answered “no, the program did not affect level of efficiency that we chose for equipment” in response to the following question: “How did the availability of information and financial incentives through the energy efficiency program affect the level of energy efficiency you chose for [Equipment/Measure]?”

The second, less restrictive criteria indicating customer plans and intentions that likely signify free ridership are as follows:

- The respondent answered “yes” to the following two questions: “Did you have plans to install the measure before participating in the program?” and “Would you have gone ahead with this planned installation of the measure even if you had not participated in the energy efficiency program?”
- Either the respondent answered “definitely would have installed” or “probably would have installed” to the following question: “If the financial incentive from the energy efficiency program had not been available, how likely is it that you would have installed [Equipment/Measure] anyway?”

- Either the respondent answered “did not affect timing of purchase and installation” to the following question: “How did the availability of information and financial incentives through the energy efficiency program affect the timing of your purchase and installation of [Equipment/Measure]?” or the respondent indicated that that while program information and financial incentives did affect the timing of equipment purchase and installation, in the absence of the program they would have purchased and installed the equipment within the next two years.
- The respondent answered “no, the program did not affect level of efficiency that we chose for equipment” in response to the following question: “How did the availability of information and financial incentives through the energy efficiency program affect the level of energy efficiency you chose for [Equipment/Measure]?”

The second factor required determining if a customer reported that a recommendation from a program representative or past experience with the program was influential in the decision to install a particular piece of equipment or measure.

The criterion indicating that program influence may signify a lower likelihood of free ridership is that either of the following conditions are true:

- The respondent answered “very important” to the following question: “How important was previous experience with the energy efficiency program in making your decision to install [Equipment/Measure]?”
- The respondent answered “yes” to the following question: “Did a representative of the energy efficiency program recommend that you install [Equipment/Measure]?”

The third factor required determining if a participant in the program indicated that he or she had previously installed an energy efficiency measure similar to one that they installed under the program without an energy efficiency program incentive during the last three years. A participant indicating that he or she had installed a similar measure is considered to have a likelihood of free ridership.

The criteria indicating that previous experience may signify a higher likelihood of free ridership are as follows:

- The respondent answered “yes” to the following question: “Before participating in the energy efficiency program, had you installed any equipment or measure similar to [Rebated Equipment/Measure] at your facility?”
- If a respondent answered “no” to the following question: “Would you have been financially able to install [Rebated Equipment/Measure] without the financial incentive from the program?” a free ridership score of 0 was assigned to the project. That is, if a participant required financial assistance from the energy efficiency program to undertake a project, then that participant was judged to not be a free rider.

- Under this criterion, the other free ridership scoring criteria were applied only to projects for participants who answered “Yes” to the question: “Would you have been financially able to install the equipment or measures without the financial incentive from the energy efficiency program?” However, respondents who answered “No” to this question would be judged to have zero free ridership even if the other free ridership criteria were applied, due to the nature of their specific survey responses.
- Table 2-4 shows the free-ridership scores that are associated with different combinations of free-ridership indicator variable values.

Table 2-3 Free-ridership Scoring Matrix: Site-Specific Approach

<i>Had Plans and Intentions to Install Measure without the program? (Definition 1)</i>	<i>Had Plans and Intentions to Install Measure without the program? (Definition 2)</i>	<i>The program had influence on Decision to Install Measure?</i>	<i>Had Previous Experience with Measure?</i>	<i>Free Ridership Score</i>
Y	N/A	Y	Y	100%
Y	N/A	N	N	100%
Y	N/A	N	Y	100%
Y	N/A	Y	N	67%
N	Y	N	Y	67%
N	N	N	Y	33%
N	Y	N	N	33%
N	Y	Y	N	0%
N	N	N	N	0%
N	N	Y	N	0%
N	N	Y	Y	0%

2.3. Sampling

Sampling is necessary to evaluate savings for the TDPUD portfolio inasmuch as verification of a census of program participants is typically cost-prohibitive. As per evaluation standard practice, samples are drawn in order to ensure 90% confidence at the +/- 10% precision level. Programs are evaluated on one of three bases:

- Census of all participants
- Simple Random Sample
- Stratified Random Sample

2.3.1. Census of Participants

A census of participant data was used for select programs where such review is feasible. An example of this is the Residential Thermally Efficient Windows program for which we surveyed a census of customers.

2.3.2. Simple Random Sampling

For programs with relatively homogenous measures (largely in the residential portfolio), the Evaluators conducted a simple random sample of participants. The sample size for verification surveys is calculated to meet 90% confidence and 10% precision (90/10). The sample size to meet 90/10 requirements is calculated based on the coefficient of variation of savings for program participants. Coefficient of Variation (CV) is defined as:

$$CV = \frac{Mean_x}{Standard\ Deviation_x}$$

Where x is the average kWh savings per participant. Without data to use as a basis for a higher value, it is typical to apply a CV of .5 in residential program evaluations. The resulting sample size is estimated at:

$$n_0 = \left(\frac{1.645 * CV}{RP} \right)^2$$

Where,

1.645 = Z Score for 90% confidence interval in a normal distribution

CV = Coefficient of Variation

RP = Required Precision, 10% in this evaluation

With 10% required precision (RP), this calls for a sample of 68 for programs with a sufficiently large population. However, in some instances, programs did not have sufficient participation to make a sample of this size cost-effective. In instances of low participation, the Evaluators then applied a finite population correction factor, defined as:

$$n = \frac{n_0}{1 + n_0/N}$$

Where

n_0 = Sample Required for Large Population

N = Size of Population

n = Corrected Sample

For example, if a program were to have only 100 participants, the finite population correction would result in a final required sample size of 41. ADM applied finite population correction factors in instances of low participation in determining samples required for surveying or onsite verification.

2.3.3. Stratified Random Sampling

For the TDPUD commercial portfolio, Simple Random Sampling is not an effective sampling methodology as the CV observed in commercial programs are typically very

high because the distributions of savings are generally positively skewed. Often, a relatively small number of projects account for a high percentage of the estimated savings for the program.

To address this situation, we use a sample design for selecting projects for the M&V sample that takes such skewness into account. With this approach, we select a number of sites with large savings for the sample with certainty and take a random sample of the remaining sites. To further improve the precision, non-certainty sites are selected for the sample through systematic random sampling. That is, a random sample of sites remaining after the certainty sites have been selected is selected by ordering them according to the magnitude of their savings and using systematic random sampling. Sampling systematically from a list that is ordered according to the magnitude of savings ensures that any sample selected will have some units with high savings, some with moderate savings, and some with low savings. Samples cannot result that have concentrations of sites with atypically high savings or atypically low savings.

3. EM&V Approach: Residential Programs

In this chapter we discuss the EM&V results (including findings and recommendations) for each residential program. Programs are listed in order of contribution to the overall portfolio. Note that several programs received a desk review only as their evaluation was either outside the scope of this report, or their size relative to the portfolio was such that the evaluation resources were better spent elsewhere.

Table 3-1 Summary of Residential Program Results

<i>Program Name</i>	<i>Gross Impacts [kWh]</i>	<i>Evaluation Approach</i>	<i>Surveyed</i>	<i>% of Portfolio</i>	<i>% Difference from 2014</i>
Million CFLs	375,885	Option A	Y	27%	-63%
Refrigerator Recycling Rebate	168,330	Option A	Y	12%	5%
Misc. Water Measures	129,061	Desk Review	N	9%	-6%
Residential Energy Survey (RES)	121,432	Option A	Y	9%	-52%
Appliance Rebate	77,345	Desk Review	N	5%	-6%
Residential Lighting Rebate	49,263	Option A	Y	4%	14%
Residential Green Partners	43,359	Option A	Y	3%	-58%
Green Schools Program	35,242	Desk Review	N	3%	-49%
Water Leak Repair Rebate	35,096	Desk Review	N	2%	-20%
Energy Saving Partners (ESP)	17,920	Option A	Y	1%	-63%
LED Holiday Light Swap	11,481	Desk Review	N	1%	-39%
Toilet Exchange Program	9,695	Desk Review	N	1%	-20%
Whole House Electric	6,152	Desk Review	N	0%	NA
Toilet Rebate Program	5,849	Desk Review	N	0%	8%
Building Efficiency Rebates	5,310	Desk Review	N	0%	132%
He Clothes Washer Water Rebate	1,258	Desk Review	N	0%	27%
High Eff. Electric Water Heater Rebate	617	Desk Review	N	0%	218%
Thermal Eff. Window Rebate	230	Desk Review	N	0%	-29%

3.1. Residential Energy Survey

Table 3-2 Residential Energy Survey: Summary Table

Final Project Count:	209
Ex Post Gross Energy Savings [kWh]:	121,432
Ex Post Gross Demand Savings [kW]:	6
Ex Post Gross Water Savings [CCF]:	6.5
Total Resource Cost [\$/kWh]:	\$ 0.18
Net-To-Gross Ratio	71%
Program Contribution to Portfolio:	9%
General EM&V Approach	Option A

The TDPUD provides residential energy surveys to non-income limited customers through the Residential Energy Survey (RES) Program. All residential energy surveys include a free energy survey and free energy and water-saving measures. The energy survey is a visual inspection only. Any measures recommended during the survey, which the District is providing for the program, are given to the residents at the time of survey. Customers are responsible for installing these free measures within 10 days of the receipt of these measures. Beginning in 2015, the program included installation of LED A19 bulbs and count towards the 12 specialty bulbs with a maximum of 2 LED bulbs per survey. Customers are also informed of District programs that they may benefit from and provided with associated literature.

3.1.1. Sampling Methodology

For programs with relatively homogenous measures, ADM conducted a simple random sample of participants. Specifically, ADM chose participants with email addresses to conduct an online survey. ADM completed 45 surveys with participants out of the total participants of the RES program.

3.1.2. Gross Impact Evaluation Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{sav} = UES * N$$

$$kW_{sav} = UES * N$$

Where:

kWh_{sav} Are the annual energy impacts for the project

- kW_{sav} Are the peak demand reductions
- UES Is the Unit energy savings estimate for the measure
- N Is the number of measures implemented

Several measures were offered through this program and various combinations/quantities were observed for each participant. ADM developed UES estimates for each measure as listed in Table 3-3.

Table 3-3 List of UES estimates for Measures offered in RES Program

Measure	Unit Energy Savings [kWh]		Unit Demand Savings [kW]	
	No Hot Water	W/ Hot Water	No Hot Water	W/ Hot Water
DR30 15/65	27	27	0.0018	0.0018
Globe G25 9/40	18	18	0.0012	0.0012
PAR 38 120/23	61	61	0.0040	0.0040
R20 14/50	22	22	0.0015	0.0015
R30 15/65	27	27	0.0018	0.0018
Spiral 13/60	26	26	0.0017	0.0017
Spiral 23/100	61	61	0.0040	0.0040
LED A19	29	29	0.0019	0.0019
Swivel Aerators	2.51	44.06	0	0
Bathroom Aerators	2.51	44.06	0	0
Kitchen Aerators	10.30	219.17	0	0
Showerheads	10.80	275.97	0	0
Spray Nozzle	3.90	3.90	0	0

The assumptions and sources used to develop each of the UES estimates in Table 3-3 can be found in the Excel workbook used to analyze the program’s impacts. This workbook can be made available to TDPUD upon request.

3.1.3. Net Impact Methods and Results

In addition to gross savings, ADM estimated associated net-to-gross ratios (NTGRs) for this program based on results from a participant survey. The net-to-gross analysis for the Residential Energy Survey program was conducted using the methodologies outlined in Section 2.1.1.1. The participant survey included several questions designed to elicit information on free-ridership, which in turn is used to estimate net-to-gross ratios. These questions corresponded with financial ability to purchase the equipment, timing of program awareness, likelihood of purchase without the incentive, and timing of the purchase. Rather than apply a binary scoring (0% vs. 100% free-ridership), ADM applied

a free-ridership probability to program participants, based upon four factors. These factors, along with the survey questions used to address them are provided in Table 3-4.

For residential programs, free-ridership is calculated as the average score determined for the sample of participants surveyed. Survey responses were scored based on the survey answers and the type of unit they purchased. These responses fell into one of three categories of what the customer would have installed without the availability of the rebate versus what they installed with the rebate. Once free-ridership is determined, ADM then estimated the Net-to-Gross Ratio (NTGR), calculated as:

$$NTGR = 1 - \% \text{ Free-Ridership}$$

Table 3-4 through Table 3-7 summarizes the responses to questions addressing free-ridership for the 2015 Residential Energy Survey Program. Based on survey responses for the 45 RES participants, ADM estimated a NTGR of 0.70 for the program. This value was multiplied by gross per-unit kWh to derive program net energy savings (kWh) and net peak demand reduction (kW).

Table 3-4 List of Net-To-Gross Factors w/ Questions: RES Energy Survey Program

#	Factor	Description	Question Used in Survey
1	Financial Ability	If the customer answers “No” they are assigned 0% free-ridership. Without financial ability to purchase the measures other factors in the decision making process are not relevant. Note that having financial ability does not inherently make one a free-rider.	Would you have been financially able to make these home improvements without the incentive from the utility?
2	Importance of Program	If the respondent answers “Definitely would”, then the respondent would be considered to be 100% free-rider. If the respondent answers “Probably would” or “Probably would not”, then the respondent is considered to have been planning to purchase the same measures with or without the rebate, and is thus a partial free-rider. If the respondent answers, “Definitely would not”, then the respondent is considered to be 0% free-rider.	If the services from the program were not available, how likely would you have been to install the same home improvements?
3	Behavior without the Program Modified by Prior Planning	If the respondent answers “No”, then the respondent is considered to have not been planning to purchase any of the measures and is 0% free-rider.	Did you have plans to make these improvements to your home prior to learning about the program?

Table 3-5 Financial Ability Results: RES Energy Survey Program

<i>Factor</i>	<i>Question</i>	<i>Yes</i>	<i>No</i>	<i>Other / DK</i>
Financial Ability	<i>Question 50: Would you have been financially able to purchase and install the measures without the rebate you received through the program?</i>	48%	26%	26%

Table 3-6 Behavior without Program Results: RES Energy Survey Program

<i>Factor</i>	<i>Question</i>	<i>Definitely Would</i>	<i>Probably Would</i>	<i>Probably Not</i>	<i>Definitely Not</i>	<i>DK</i>
Importance of Program	<i>Question 51: If the services from the program were not available, how likely would you have been to install the same home improvements?</i>	7%	34%	49%	5%	15%

Table 3-7 Behavior w/o Program Modified by Prior Planning Results: RES Energy Survey Program

<i>Factor</i>	<i>Question</i>	<i>Yes</i>	<i>No</i>	<i>Other / DK</i>
Behavior W/O Program Modified by Prior Plan Existence	<i>Question 49: Did you have plans to make these improvements to your home prior to learning about the program?</i>	24%	56%	20%

In addition to gross savings, ADM estimated associated net-to-gross ratios (NTGRs) for all measures based on results from the participant survey. Based on the survey responses for the 46 participants, specific to the RES program, ADM estimated NTGRs of 0.71. These values were multiplied by gross per-unit kWh. Net savings values are shown in Table 3-8.

Table 3-8 Net Impact Summary: RES Energy Survey Program

<i>Free-ridership</i>	<i>Net-to-Gross Ratio</i>	<i>Net Annual Savings (kWh)</i>	<i>Net Peak Demand Savings (kW)</i>	<i>Net Water Savings (CCF)</i>
0.29	0.71	86,338	4.6	6.5

3.1.4. Participant Satisfaction Survey Results

ADM contacted 113 participants of the RES programs from which we received 45 total responses (37.2% response rate). The purpose of this survey was focused on collecting data used to determine the net-to-gross ratio; however, additional data was collected to qualify the following:

- Customer awareness of the program;
- Surveyor satisfaction;
- Installation rates; and
- Customer satisfaction with the Residential Energy Savings program.

3.1.4.1. Program Awareness

Respondents were asked how they learned about the RES program and were asked to indicate all the ways they had learned about the program. These answers equate to more than 100%. Figure 2-1 summarizes how respondents learned about the program. The most common ways respondents learned about the program was through utility program staff (28.9%), word-of-mouth (24.4%), and a bill insert (20%). In-person marketing of the program is the most frequent source of information.

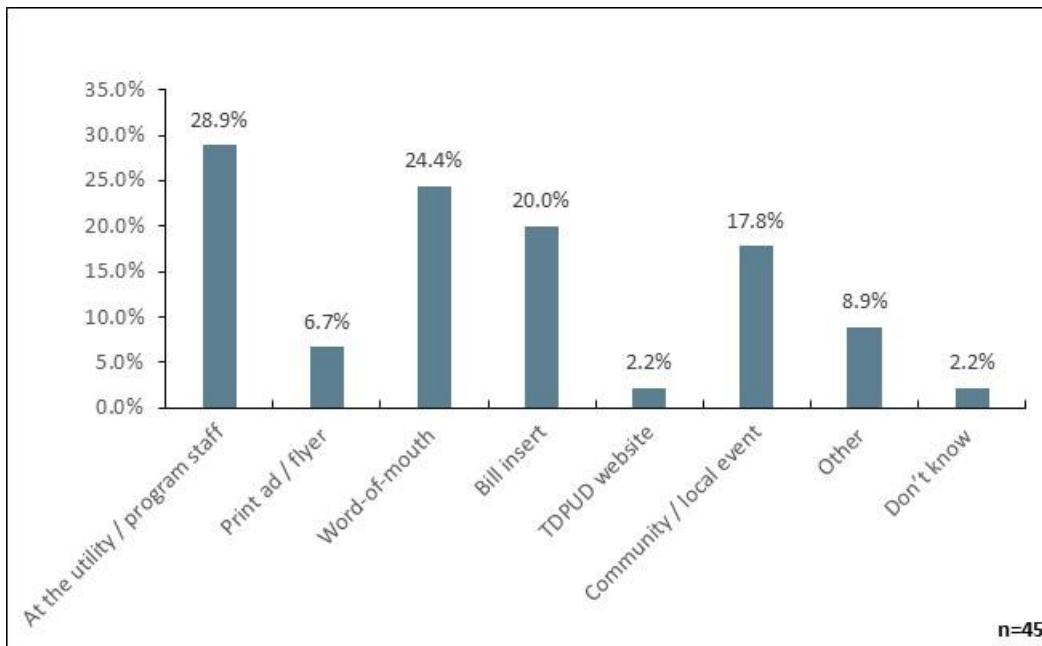


Figure 3-1 Sources of Program Awareness

3.1.4.2. Participant Decision-Making Processes

Respondents were asked several questions regarding their decision-making processes including why they chose to participate in the program and which of these reasons they

considered to be the most important. The responses are listed in Figure 3-2 where we show the frequency each reason was cited (the teal bars) as well as the frequency each reason was considered to be the most important (green). The most frequent answer was to save energy (91.1%) followed closely by a reduction to their utility bill (84.4%). The most important reason respondents chose to participate in the program was to save energy (51.1%). Figure 3-2 summarizes these results.

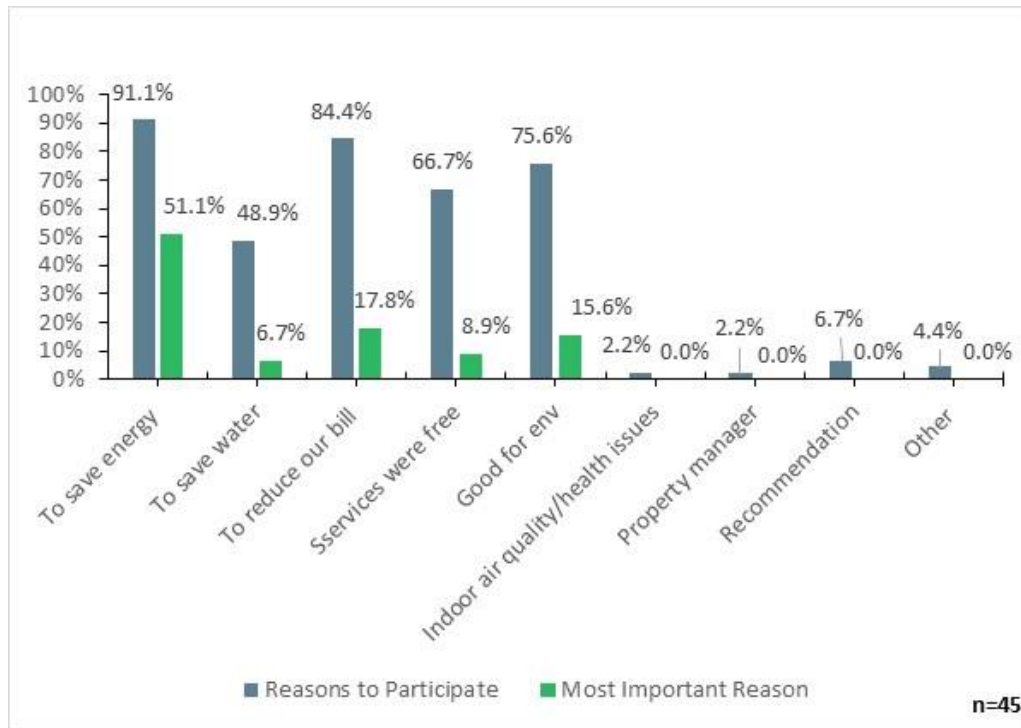


Figure 3-2 Reasons for Participation

Sixty-one percent of respondents indicated that they did not have existing plans to make improvements on their homes prior to learning about the program. However, 41% of respondents stated that they would have likely installed the same home improvements without assistance from the program. Forty-eight percent of respondents indicated that they would have been financially able to make the home improvements without the incentives from the utility.

3.1.4.3. Measure Installation Rates and Satisfaction

Respondents were initially asked what measures were installed in their homes and then answered questions regarding the survey and installation work done in their homes by the surveyor. They were also asked whether they had removed any of the fixtures and to clarify why they had been removed. Participants could receive the following measures:

- CFLs (Direct Install);
- LEDs (Direct Install);

- Low flow showerheads (Direct Install);
- Kitchen, bathroom, and/or swivel aerators (Self-Install);
- Hose spray nozzle (Self-Install);
- Weather-stripping (Self-Install);
- A door sweep (Self-Install);
- Pipe, elbow and/or tee insulation (Self-Install);
- Water heater jacket (Self-Install); and
- A toilet leak detection kit (Self-Install).

Table 3-9 shows the installation rates calculated by the Evaluators and based on the survey respondents.

Table 3-9 Measure Installation Rates

<i>Measures</i>	<i>Installation Rate</i>	<i>N</i>
CFL	83%	29
LED	81%	32
Low Flow Shower Head	100%	22
Kitchen/Bathroom/ Swivel Aerator	92%	12
Hose Spray Nozzle	100%	7
Weather-stripping	97%	32
Door Sweep	100%	7
Pipe/Elbow/ Tee Insulation	100%	14
Water Heater Jacket	100%	6

3.1.4.3.1. CFLs

Twenty-nine respondents reported having CFLs installed in their homes. Forty-five percent of respondents had the surveyor install some or all of their CFL bulbs, and rated the surveyor with high satisfaction (4.85 out of 5). Respondents rated their satisfaction of the CFLs with a mean score of 4.00 (out of 5), and most respondents said that the quality of the CFLs were either the same or higher quality than the bulbs that were installed previously. Ten percent of respondents said they had removed some of the bulbs in their homes. One respondent clarified that they removed the bulbs because they were not bright enough, and one had replaced it with an LED bulb.

3.1.4.3.2. LEDs

Thirty-two respondents reported having LEDs installed in their homes. Forty-five percent of respondents had the surveyor install some or all of their LED bulbs, and rated the

surveyor's work with high satisfaction (4.85 out of 5). Respondents rated their satisfaction of the LEDs with a mean score of 4.00 (out of 5) and most respondents said that the quality of the LEDs were either the same or higher quality than the bulbs they had installed previously. Ten percent of respondents said they had removed some of the bulbs in their homes. One respondent clarified that they removed them because they were not bright enough, and one of the LED bulbs had stopped working.

3.1.4.3.3. Showerheads

Twenty-two respondents reported having showerheads installed in their homes. Half of the respondents had one showerhead installed while the remaining had two installed. Thirty-six percent of respondents had the surveyor install some or all of the showerheads, and rated the surveyor's work with high satisfaction (5 out of 5). Respondents rated their satisfaction of the showerheads with a mean score of 3.60 (out of 5). None of the respondents have removed the showerheads.

3.1.4.3.4. Aerators

Twelve respondents reported having aerators installed in their homes. Fifty percent of respondents had one aerator installed in their home, 33% percent had two aerators installed, and 17% had three aerators installed. Fifty-eight percent of respondents had the surveyor install some or all of the aerators, and rated the surveyor's work with high satisfaction (4.50 out of 5). Respondents rated their satisfaction of the aerators with a mean score of 3.83 (out of 5). One respondent removed one aerator because it did not have enough flow.

3.1.4.3.5. Hose Spray Nozzles

Seven respondents reported having hose spray nozzles installed in their homes. All the respondents had one hose spray nozzle installed in their home and self-installed the fixture. Respondents rated their satisfaction of the fixture with a mean score of 4.67 (out of 5). None of the respondents have removed the hose spray nozzle.

3.1.4.3.6. Weather-stripping

Thirty-two respondents reported having weather-stripping installed in their homes. Ninety-one percent of respondents had the surveyor install some or all of the weather-stripping, and rated the surveyor's work as satisfactory (4.34 out of 5). Respondents rated their satisfaction of the weather-stripping with a mean score of 4.72 (out of 5). One respondent removed some of the weather-stripping because their door would not properly close.

3.1.4.3.7. Door Sweeps

Seven respondents reported having a door sweep installed in their homes. Forty-three percent of respondents had the surveyor install the door sweep, and rated the surveyor's

work with high satisfaction (5 out of 5). Respondents rated their satisfaction of the door sweep with a mean score of 4.29 (out of 5). None of the respondents have removed the door sweep.

3.1.4.3.8. Insulation

Eleven respondents reported having hot water pipe insulation installed in their homes. Twenty-one percent of respondents had the surveyor install the insulation, and rated the surveyor's work with high satisfaction (5 out of 5). Respondents rated their satisfaction of the measure with a mean score of 4.80 (out of 5). None of the respondents have removed any of the insulation.

3.1.4.3.9. Water Heater Jackets

Six respondents reported having water heater jackets installed. Most of the respondents (83%) self-installed the measure while the remaining could not recall who installed the jacket. Respondents rated their satisfaction of the measure with a mean score of 4.60 (out of 5). None of the respondents have removed the water heater jacket.

3.1.4.4. Surveyor Satisfaction

Respondents were asked questions about installation quality, professionalism, and experience with the surveyor. Ninety-eight percent of respondents thought that surveyor was professional and knowledgeable. Respondents were also asked about their satisfaction for the surveyor with each measure installed, and all respondents rated high satisfaction towards the surveyor ranging starting at 4.34 or higher (out of 5).

3.1.4.4.1. Participant Demographics

Finally, respondents were voluntarily asked to give demographic information. Seventy-three percent of respondents lived in a single-family home while the remaining lived in condominiums. Eighty-five percent owned their homes. Approximately, 73% of those homes were between 1,000 and 2,500 square feet, 22% were larger than 2,500 square feet, and 4% were smaller than 1,000 square feet. Almost 44% of respondents had two people living in their home, 29% had three to five people living in the home, and 4% had up to 7 people living in the home. Although 22% of respondents declined to answer their total household income, 60% of respondents fell within an income bracket of making \$70,000 and higher, and 18% made \$50,000 or less.

3.1.4.5. Overall Program Satisfaction

Respondents were asked to rate several program elements on a scale of 1 to 5, where "5"; is very satisfied and "1" is very dissatisfied. Table 3-10 summarizes respondents' satisfaction towards each element.

Table 3-10 Residential Survey Participant Satisfaction

<i>Element of Program Experience</i>	<i>Very Satisfied</i>	<i>Somewhat Satisfied</i>	<i>Neutral</i>	<i>Somewhat Dissatisfied</i>	<i>Very Dissatisfied</i>	<i>Score</i>	<i>Don't Know</i>
Information provided by the surveyor	89%	0%	2%	0%	0%	4.95	9%
The quality of installation work by the surveyor	80%	0%	0%	0%	0%	5.00	20%
The savings on your monthly bill	4%	16%	18%	2%	2%	3.42	58%
The service provided by utility staff	71%	13%	0%	0%	0%	4.84	16%
Information provided by TDPUD on how to reduce your utility bill	49%	29%	9%	2%	0%	4.40	11%
Improvement in home comfort after receiving the home improvements	29%	18%	18%	2%	0%	4.10	33%
Overall program experience	73%	18%	0%	0%	0%	4.80	9%

Overall, respondents are highly satisfied with the Residential Energy Survey Program. Respondents had scored program elements with highest satisfaction included the quality of work by the surveyor (5.00), information provided by the surveyor (4.95), and the service provided by utility staff (4.84).

The program element that scored the lowest was the savings on the monthly bill. Many respondents indicated that they were unsure if there was a difference in their bill and said that they did not notice a difference. However, respondents reported noticing a difference in their electric bill (29%), a difference in their water bill (22%), and some respondents saw a difference in both bills (7%). Some comments regarding saving on the monthly bill included:

- *“House is still very cold and bills have not decreased as far as I can tell.”*
- *“I haven't seen a huge savings in our bills yet.”*

The surveyor received very high satisfaction and many respondents commented:

- *“The surveyor was awesome! I wrote in a letter about him after he came - he was extraordinary and very helpful and knowledgeable!”*
- *“Our surveyor was excellent and went above and beyond the required client service. He was super helpful and very knowledgeable.”*
- *“The surveyor was really nice, knowledgeable and helpful and I appreciated receiving light bulbs and water heater insulation.”*
- *“...Our surveyor [sic] not only provided lots of energy saving info, products, and installs, he helped us detect a broken back flow valve that was leaking under the house. If it had not been for him we probably would have suffered water damage. Now our water bill is under control, and the house is running more efficiently.”*

Respondents also had positive comments about the program, which included:

- *“I think the program is beneficial and a positive for the environment.”*
- *“I think this is one [of] the best services I have ever used from a district. Please keep this going, it is a true service to the community, and planet.”*
- *“We were so very impressed with the service and have recommended it to others in our neighborhood. Keep up the great work! We are elderly and could not do some of the work (installation of weather-stripping) ourselves.”*

Finally, respondents had comments and suggestions for improvement to the program. Many of the comments were very positive saying that they thought the utility was doing a good job, it was a good program, high praise for the surveyor who performed the work, and the program was a great experience. Examples of some responses received included:

- *“Better outreach to make it more well-known. e.g. Ads in the local rags and magazines (or maybe you do and I haven't seen them).”*
- *“...The only thing I would do to improve would be to have more workers so we wouldn't have to wait so long to get an appointment.”*

1.1.1 Evaluation Findings and Program Recommendations

The following represent ADM's key findings for the CY 2015 evaluation of the Residential Energy Survey program:

- **High customer satisfaction with the program.** The evaluation found that participants in the RES Program were highly satisfied with the program surveyor and their interactions with program staff.
- **Participants report high levels of satisfaction with their surveyor.** Many of the participants were greatly appreciative of the information provided by their surveyor.

- **Reduced savings potential for lighting measures.** Application of EISA standards for gross impact baseline reduced unit energy savings from CFL and LED measures relative to last year.

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Additional follow-up with participants regarding measure installations.** For those that choose to self-install rather than have the surveyor install on-site, send a reminder to participants to install the measures. The reminder can be packaged as a thank you card or email, thanking the customer for their participation and reminding them of the savings they will see with full installation of the kit. This delivery mechanism can provide gentle a reminder to customers to install their equipment.
- **Increase offerings of LED lighting.** As LED lighting costs continue to drop and their consistency in quality increases the measure is becoming much more cost effective. Furthermore, CFLs are starting to saturate the market and suffer higher rates of free-ridership.
- **Increase cross-promotion of other TDPUD residential programs.** The majority of customers reported hearing about TDPUD's programs through program staff. Since program staff are already present to provide the energy survey this represents a good opportunity to directly inform customers about TDPUD's other programs. Although many customers received rebates for other appliances, they may be unaware of the full portfolio of residential programs TDPUD offers.
- **Consider adding a nominal cost-share to survey.** In order to improve program cost effectiveness, consider implementing a nominal cost for the energy survey.

3.2. Residential - Refrigerator Recycle

Table 3-11 Residential - Refrigerator Recycle: Summary Table

Final Project Count:	155
Ex Post Gross Energy Savings [kWh]:	168,330
Ex Post Gross Demand Savings [kW]:	26
Total Resource Cost [\$/kWh]:	\$0.05
Net-To-Gross Ratio:	62%
Program Contribution to Portfolio:	12%
General EM&V Approach:	Option A
Survey Sample Size	29

The Refrigerator Recycle program promotes the recycling of older, working refrigerators and freezers by providing customers with free pickup and a \$30 rebate. This program is implemented through a 3rd party vendor. The vendor is responsible for verification of customer eligibility, scheduling, verification of unit operation, pick up from the customer and delivery to a recycling facility. The program is available to customers during vendor regular business hours.

3.2.1. Sampling Methodology

For programs with relatively homogenous measures, ADM conducted a simple random sample of participants. Specifically, ADM chose participants with email addresses to conduct an online survey. ADM contacted 77 participated and completed 29 surveys with participants out of the total participants of the Refrigerator Recycling program.

3.2.2. Gross Impact Evaluation Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = UES_{kWh} * N$$

$$kW_{Sav} = kWh_{Sav} * f_{kW}$$

Where:

- kWh_{Sav} Are the annual energy impacts for the project
- kW_{Sav} Are the peak demand reductions
- UES_{kWh} Is the unit energy savings estimate for the measure

- f_{kW} Is a factor used to convert annual kWh to peak demand savings.² $f_{kW} = 0.000154 \text{ kW/kWh}$
- N Is the number of rebated units.

Insufficient data was present for the evaluation to implement the preferred method outlined in the Uniform Methods Project protocol for Refrigerator/Freezer recycling program evaluation. UES values for this program were therefore derived using secondary literature research. In particular, ADM recently completed a Refrigerator/Freezer recycling program evaluation for SMUD in which we collected primary data. The unit energy savings estimates from this recent evaluation were compared to several other sources of UES estimates (previous TDPUD program evaluations, the CMUA TRM, and the Regional Technical forum). The final values used for this evaluation are listed in Table 3-12.

Table 3-12 List of UES Estimates: Residential - Refrigerator Recycle

<i>Equipment</i>	<i>UES (kWh/Unit)</i>
Refrigerator	1,083
Freezer	1,089

3.2.3. Net Impact Methods and Results

ADM contacted 77 participants of the Refrigerator Recycling program via online survey from which we completed 29 responses (37.6% response rate). The net-to gross analysis for the Refrigerator Recycling program was conducted using the methodologies outlined in 2.1.1.1. Determining the net effects of the program rebate requires estimating the percentage of energy savings from unit removal that would have occurred without program intervention. These questions corresponded with what respondents' behavior without the program.

For residential programs, free-ridership is calculated as the average score determined for the sample of participants surveyed. Survey responses were scored based on the survey answers. Table 3-13 provides a list of the net-to-gross factors and the survey questions that correspond to determine free-ridership.

² This factor derived using entries from DEER 2015 for this measure: $f_{kW} = kW_{DEER} / kWh_{DEER}$

Table 3-13 List of Net-To-Gross Factors and Questions Addressing Them: Refrigerator Recycling Program

#	Factor	Description	Question Used in Survey
1	Keep Unit	If the customer answers “Keep the unit”, the customer is considered to be a free-rider.	Q6: When replacing a major appliance, what do you typically do with the old unit?
		If the customer answers “Continued to use it”, the customer is considered to be a free-rider.	Q8: What would you have done with your old appliance if you had not recycled it through the program?
2	Transfer Unit	If the customer answers “Sold to a private party”, “Sold/gave to a used appliance dealer”, “Gave to a friend/family member”, or “Donate it”, the customer is considered to be a free-rider.	Q6: When replacing a major appliance, what do you typically do with the old unit?
		If the customer answers “Sold it” or “Given it away/donated”, the customer is considered to be a free-rider.	Q8: What would you have done with your old appliance if you had not recycled it through the program?
3	Keep in Storage	If the customer provided an answer of “Unplugged and stored it”, the customer is considered to be a free-rider.	Q8: What would you have done with your old appliance if you had not recycled it through the program?
4	Destroy Unit	If the customer answers “Removed by dealer when replacement unit came”, “Dispose or recycle it myself”, or “Hire someone to dispose or recycle it for me”, the customer is considered to be a free-rider.	Q6: When replacing a major appliance, what do you typically do with the old unit?
		If the customer answers “Disposed of it”, the customer is considered to be a free-rider.	Q8: What would you have done with your old appliance if you had not recycled it through the program?

Based on survey responses for the 29 participants, ADM estimated a NTGR of 0.62 for the program. This values was multiplied by gross per-unit kWh to derive program net savings [kWh] and net peak demand reduction [kW]. Program NTGR and associated Net savings values are shown in Table 3-14.

Table 3-14 NTGR and Net Impacts for Refrigerator Recycling Program

<i>Free Ridership</i>	<i>NTG Ratio</i>	<i>Ex Post Net Annual Energy Savings [kWh]</i>	<i>Ex Post Net Peak Demand Reductions [kW]</i>
0.38	0.62	104,481	16.14

3.2.4. Participant Satisfaction Survey Results

ADM contacted 77 participants of the Refrigerator Recycling program via online survey from which we completed 29 responses (37.6% response rate). The purpose of this survey was focused on collecting data used to determine the net-to-gross ratio; however, additional data was collected to qualify the following:

- Customer awareness of the program;
- Customer decision-making process; and
- Customer satisfaction with the Refrigerator Recycling program.

3.2.4.1.1. Program Marketing

Respondents were asked about how they learned about the TDPUD Refrigerator Recycling program. Figure 3-3 summarizes the sources of awareness indicated by program participants. A majority of respondents learned about the program from the retailer or in-store promotions (69%) while others learned about the program through a TDPUD bill insert (21%).

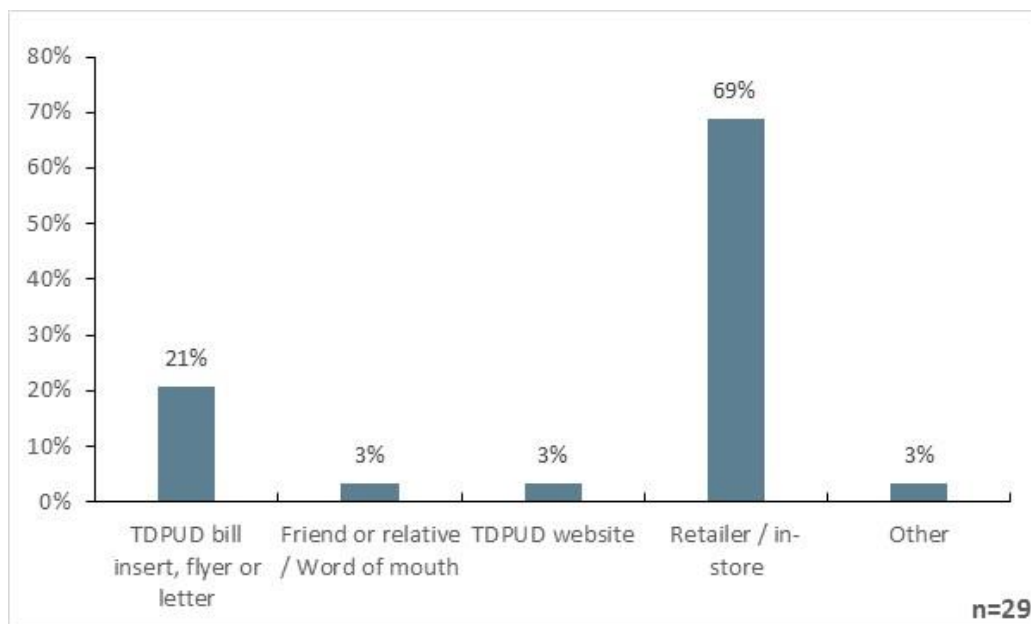


Figure 3-3 Source of Program Awareness

3.2.4.1.2. Usage of Recycled Units

Respondents were asked questions related to the usage of the recycled unit. These questions addressed unit location, condition, and how many months a year the unit was in use. Table 3-15 summarizes these results for refrigerators and freezers.

Table 3-15 Location of Use of Recycled Units

<i>Room</i>	<i>% Indicated</i>
Kitchen	86.2%
Garage	13.8%
<i>n = 29</i>	

Respondents were then asked to describe the working condition of the recycled refrigerator or freezer. Customers were asked if the unit:

- Was in good working condition;
- If it worked well but needed minor repairs, such as a handle or gasket;
- If it worked but had serious problems, such as not defrosting properly; or
- If it didn't work at all.

The results are summarized in Table 3-16.

Table 3-16 Condition of Recycled Units

<i>Condition</i>	<i>% indicated</i>
In good condition	41.4%
Needed minor repairs	24.1%
Had serious problems	31.0%
Didn't work at all	3.4%
Don't Know	0%
<i>n=29</i>	

Respondents were also asked whether they had considered discarding their refrigerator or freezer prior to hearing about the program. Specifically, they were asked:

When did you learn about the Refrigerator Recycling Program and the available rebate?

As summarized in Table 3-17, an average of 89.7% of respondents learned of the program either before or during their decision to dispose of their refrigerator or freezer.

Table 3-17 Timing of Learning of Program Relative to Decision to Recycle

<i>Timing of Learning of Program</i>	<i>% Indicated</i>
Before deciding to recycle	62.1%
While deciding to recycle	27.6%
After deciding to recycle	10.3%
<i>n=29</i>	

Eighty-three percent of the refrigerators were described as a main unit while the remaining 17% was used as a secondary unit. The main reasons participants wanted to replace the unit is because they wanted a better working unit (24.1%) or a more efficient unit (24.1%). Table 3-18 summarizes the reasons respondents chose to replace their units.

Table 3-18 Reasons for Replacement

<i>Main Reason for Replacement</i>	<i>% Indicated</i>
Wanted a better working unit	24.1%
Wanted a newer unit	17.2%
Wanted a more efficient unit	24.1%
Wanted a different size/type	3.4%
Remodeling home	17.2%
Other	6.9%
<i>n=29</i>	

For those respondents who were recycling a secondary unit, they were asked about the usage of that unit prior to recycling in the past year. Three of five respondents said that unit operated year-round while the remaining two said the unit was used only a portion of the year (between 4 and 5 months).

3.2.4.1.3. Motivation to Participate

Participants were asked how they would have disposed of their appliances without the program and what influenced that decision.

Fourteen percent of participants had a specific plan on how to dispose of their refrigerator before learning about the program. Typically, participants would have the unit removed by the dealer when their replacement unit comes (41.1%), give it to a friend or family member (17.2%), or dispose or recycle the unit themselves (13.8%). Figure 3-4 shows what participants would typically chose to do when replacing a major appliance.

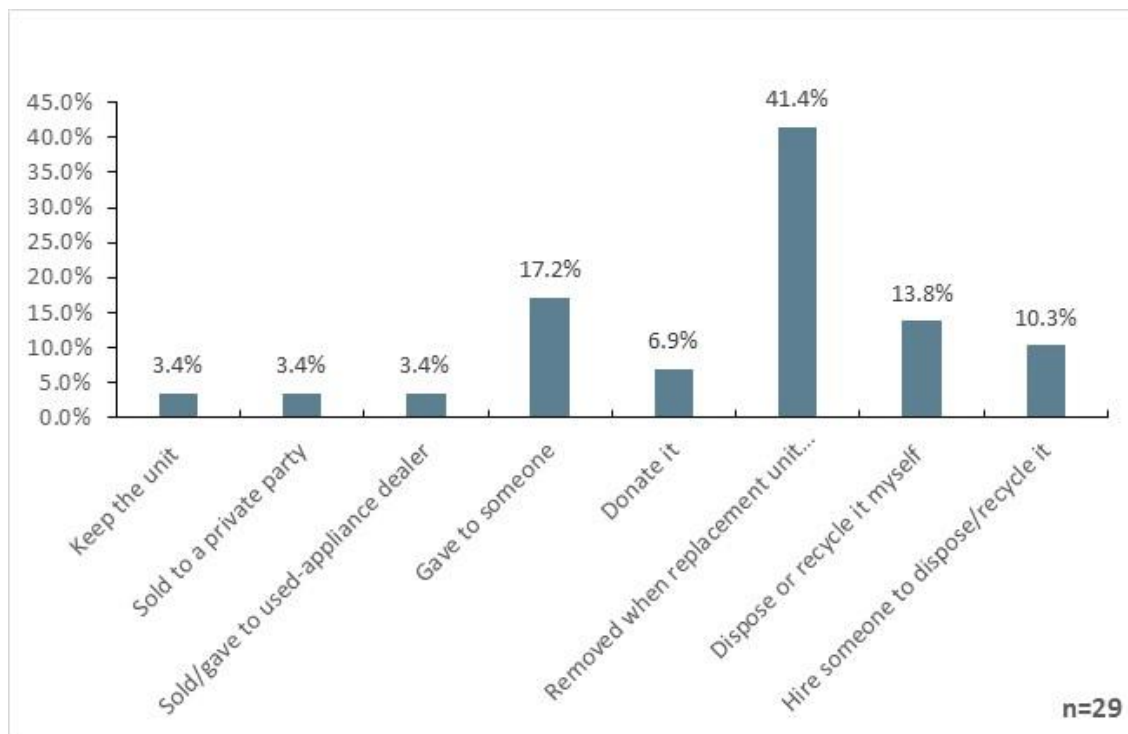


Figure 3-4 Ways of Replacing a Major Appliance without the Program

Only one respondent said they would typically sell a major appliance without the program, but would prefer to sell to a used refrigerator/appliance dealer over a private party. Two respondents did attempt to sell or donate their refrigerator prior to participating in the program. The reasons they were unable to follow through with the sale was because they could not find an interested buyer at the price they wanted or they had decided that it was more important to recycle the unit rather than selling it. Respondents were asked what

they would have done with the unit without the program. Figure 3-5 summarizes their responses.

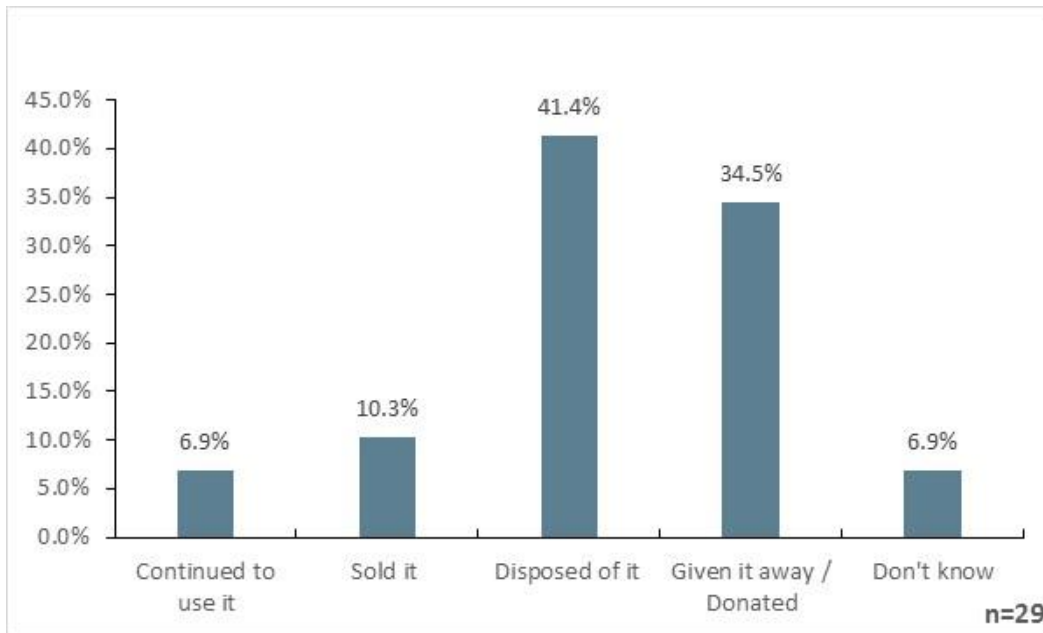


Figure 3-5 Behavior without the Program

If the program were unavailable, most participants would dispose of the unit (41.4%) or given it away (34.5%). Two respondents stated that they would have continued to use the unit.

In the participant survey, respondents were asked to indicate all their reasons for participating in the program (Summarized in

Table 3-19). The top two factors listed by program participants as motivators were the rebate and purchased a new unit. Other motivating factors for respondents included recycling the unit was good for the environment (37.9%) and the convenience of the free pickup (34.5%).

Table 3-19 Reasons Indicated for Program Participation

Motivation	% Indicated
The rebate	51.7%
Energy cost savings	20.7%
Good for the environment	37.9%
Refrigerator no longer worked properly	6.9%
Purchased new refrigerator or freezer	44.8%
Convenience of free pickup	34.5%
Other	3.4%
Don't know	0%
n=29	

3.2.4.1.4. Rebate Feedback

In general, participants received their rebate within two to four weeks after they recycled their unit (31%) and 24% received their rebate four weeks or later. A majority of respondents (38%) could not recall how long it took to receive their rebate. Only 7% of respondents said that the wait-time to receive the rebate was too long. Fifty-five percent of respondents said that the rebate was at least somewhat important in their decision to recycle the unit, 21% said it was only slightly important, and 17% said it was not important in their decision.

3.2.4.1.5. Program Satisfaction

The participant survey for the Refrigerator Recycling Program included questions addressing participant satisfaction with an array of program components and processes as well as for the program as a whole.

Table 3-20 summarizes participant responses when asked to rate satisfaction a scale of 1 to 5, with 1 meaning “Very Dissatisfied” and 5 meaning “Very Satisfied”.

Table 3-20 Participant Satisfaction with Program Components

Program Component	Mean Score	Don't Know
The scheduling process for recycling	3.62	21%
The service performed by staff that picked up your refrigerator	3.41	28%
The wait time between scheduling and pick-up of the refrigerator	3.52	24%
The wait time to receive the rebate	3.21	14%
The rebate amount	3.41	10%
Information provided by TDPUD program staff	3.66	17%
Overall program experience	4.21	3%

A majority of the participants rated all the statements with fairly high satisfaction, and were very satisfied with the service and overall program experience. However, a small number of respondents indicated some dissatisfaction with information provided (types of qualifying units) and the overall program. Those that were particularly unsatisfied with these elements said they had issues receiving their rebate and that there was misinformation about the approved units.

3.2.4.1.6. Participant Demographics

Finally, respondents were voluntarily asked to give demographic information. Ninety-three percent of respondents lived in a single-family home while the remaining lived in condominiums, and all respondents owned their homes. Approximately, 79% of those homes were between 1,000 and 2,500 square feet, 14% were larger than 2,500 square feet, and 3% were smaller than 1,000 square feet. Almost 52% of respondents had two people or less living in their home and 23% had three to six people living in the home. Others could not specify how many people lived in the home because it was a secondary or vacation home. Although 14% of respondents declined to answer their total household income, 76% of respondents fell within an income bracket of making \$70,000 and higher, and only 6% making \$50,000 or less.

3.2.5. Evaluation Findings and Program Recommendations

The following represent ADM's key findings for the CY 2015 evaluation of the Refrigerator Recycling program:

- **Good customer satisfaction with the program.** The evaluation found that participants in the Refrigerator Recycling Program were satisfied by the overall program. However, some respondents had issues with the rebate process.
- **Participants learned about the program from the retailer.** Respondents indicated that learned about the program from the retailer. Maintaining a relationship with the retailer and updating them on information regarding the program is important to the program's success.

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Retailer Updates.** A majority of respondents indicated learning about the Refrigerator Recycling program while in-store. Keeping retailers updated on program specific details such as application deadlines and qualifying units will continue the success of this program.
- **Modify Application Process to Track Additional Data.** If additional data is tracked in Energy Orbit (or separate tracking database) regarding rebated customer equipment, the UMP protocol for this program-type can be applied directly. This would improve the quality of the evaluation results without any added cost.³ These data include:
 1. Appliance age
 2. Appliance size (square feet)
 3. Appliance manufacture date
 4. Appliance primary Usage type
 5. Appliance configuration (side-by-side, Single door, etc.)
 6. Appliance location (Indoor vs. Outdoor)

³ The UPM Protocol specifies a regression with specific variables based on equipment and population characteristics. Ideally monitoring/surveying would be done to establish regression coefficients specific to the program being evaluated. However; "stock" coefficients are provided where resources are not available for primary data collection.

3.3. Residential – Green Partners Program

Table 3-21 Residential - Green Partners: Summary Table

Final Project Count:	248
Ex Post Gross Energy Savings [kWh]:	43,359
Ex Post Gross Demand Savings [kW]:	3
Total Resource Cost [\$/kWh]:	\$0.11
Net-To-Gross Ratio:	69%
Program Contribution to Portfolio:	3%
General EM&V Approach	Option A
Survey Sample Size	26

The Residential Green Partners (Green Partners) program encourages customers to replace incandescent and halogen light bulbs with energy efficient lighting by distributing, in person and for free, 7-types of Compact Fluorescents (CFLs) and 1-type of LED to customers who visit the TDPUD Conservation Department or at a local event. CFL give-a-ways include a 12-pack of 60-watt equivalent spiral CFLs and up to 12 mix-n-match specialty CFLs. A maximum of 2 LEDs per customer and they have received a Residential Energy Survey prior to 2015 to receive the LEDs. This program also includes the Neighborhood Block Party program for measure count and associated program costs.

3.3.1. Sampling Methodology

For programs with relatively homogenous measures, ADM conducted a simple random sample of participants. Specifically, ADM chose participants with email addresses to conduct an online survey. ADM contacted 161 participants out of the total participants of the Green Partners program.

3.3.2. Gross Impact Evaluation Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = (kW_{Base} - kW_{CFL}) * Hrs * HCIF * ISR$$

$$kW_{Sav} = (kW_{Base} - kW_{CFL}) * CDF * HCIF * ISR$$

Where:

- kWh_{Sav} Are the annual energy impacts for the project
- kW_{Sav} Are the peak demand reductions

kW _{Base}	Is the connected load of the baseline light bulb ⁴
kW _{CFL}	Is the connected load of the installed light bulb ⁵
Hrs	Are the annual hours of operation ⁶
HCIF	Heating/Cooling Interactive Factor ⁷
CDF	Is the Coincident Demand Factor
ISR	Is the <i>In-Service Rate</i>

The *In-Service Rate* was derived using customer surveys to identify how many of the bulbs received had actually been installed. Additional questions were asked to identify the locations in which the bulbs were installed. The installation rates for CFLs and LEDs were found to be 83% and 74%, respectively, and bulbs were distributed throughout the homes and outside. Table 3-22 provides a breakdown of the location in which bulbs were installed based on survey respondents. Table 3-22 also lists the assumed hours of use for each location and overall calculated hours of use (Hrs) used in the program analysis. The hours of use for each location are based on the results from the most recent evaluation on the California IOU's upstream lighting program for the 2006-2008 program cycle.⁸ The values used were for PG&E's service territory.

⁴ Assessed using an assumed baseline wattage based on the wattage/type of the installed bulb and further informed through surveys

⁵ Based on the records kept in the tracking system and further informed by the surveys

⁶ Per DEER 2013 for appropriate building type

⁷ Per DEER 2013 for appropriate building type

⁸ http://www.energydataweb.com/cpucfiles/18/finalupstreamlightingevaluationreport_2.pdf (Table 84, Overall/Overall)

Table 3-22 Summary of Installation Location: Residential Green Partners

<i>Location</i>	<i>Hours of Use</i>	<i>CFLs % Observed</i>	<i>LEDs % Observed</i>
Bathroom	1.2	10%	8%
Bedroom	1.4	14%	25%
Dining	1.6	5%	1%
Exterior	3.7	3%	1%
Garage	1.8	2%	4%
Hall	1.2	14%	1%
Kitchen	2.3	10%	0%
Living	2.2	33%	44%
Office	1.2	2%	0%
Other	1.4	6%	1%
Unknown	1.8	0%	15%
Total	2.4	100%	100%

The Coincident Demand Factor (CDF), and interactive factors (HCIF) were sourced from the DEER and then applied to program results. The Ex Post gross impacts are provided in Table 3-23.

Table 3-23 Gross Impacts for Residential Green Partners Program

<i>Gross Ex Post Annual Energy Impacts [kWh]</i>	<i>Gross Ex Post Peak Demand Reductions [kW]</i>
43,359	2.80

3.3.3. Net Impact Methods and Results

In addition to gross savings, ADM estimated associated net-to-gross ratios (NTGRs) for this program based on results from a participant survey. The net-to gross analysis for the Green Partners program was conducted using the methodologies outlined in Section 2.1.1.1. The participant survey included several questions designed to elicit information on free-ridership, which in turn is used to estimate net-to-gross ratio. These questions corresponded with financial ability to purchase the equipment, timing of program awareness, likelihood of purchase without the incentive, and timing of the purchase.

For residential programs, free-ridership is calculated as the average score determined for the sample of participants surveyed. Survey responses were scored based on the survey answers and the type of measures they received and installed. These responses fell into one of four categories of what the customer would have installed without the availability of the program versus what they installed with the program. These factors, along with the survey questions used to address them are provided Table 3-24.

Table 3-24 List of Net-To-Gross Factors & Questions: Residential - Green Partners

#	Factor	Description	Question Used in Survey
1	Behavior without Giveaway	If the customer answers “Definitely would”, then the customer is considered to have not been planning to purchase any of the measures and is 100% free-rider. If the customer answers “Probably” or “Probably not”, then the customer is considered to a partial free-rider. If the customer answers “Definitely not”, then the customer is assigned 0% free-rider.	Q1: If the utility had not given out the CFL/LEDs, how likely is it that you would have purchased those types of light bulbs anyway?
2	Tendency to Buy Incandescent Bulbs	The answer to this question helps to modify the corrected behavior without the giveaway.	Q2: Have you purchased any incandescent light bulbs in the past year?
3	Corrected Behavior w/o giveaway (incorporating incandescent tendency)	If the customer answered Tendency to Buy Incandescent question as “Yes”, the Behavior Without the Giveaway modified the free-ridership score associated with the customer.	-
4	Prior Experience	Customers were assigned free-ridership scores based on the types of bulbs that were replaced by the free CFLs or LEDs in their home. Depending on their answer, they were assigned 0%, 50%, or 100% free-ridership scores.	Q3: What type of bulbs did the new CFL/LED bulbs replace?

Table 3-25 through Table 3-27 summarizes the responses to questions addressing free-ridership for the 2015 Green Partners Program.

Table 3-25 Importance of Program Results: Residential - Green Partners

Factor	Question	Definitely would	Probably would	Probably would not	Definitely would not
Importance of program	Question 8: If the utility had not given out the CFL/LEDs, how likely is it that you would have purchased those types of light bulbs anyway?	8%	35%	54%	4%

Table 3-26 Tendency to Buy Incandescent Bulbs: Residential - Green Partners

Factor	Question	Yes	No	Don't know
Tendency to Buy Incandescent Bulbs	Question 11: Have you purchased any incandescent light bulbs in the past year?	23%	73%	4%

Table 3-27 Prior Planning Results: Residential - Green Partners

<i>Factor</i>	<i>Question</i>	<i>Incandescent</i>	<i>CFLs</i>	<i>LEDs</i>	<i>Don't know</i>
Prior Planning	<i>Question 5: What type of bulbs did the new CFL bulbs replace?</i>	77%	15%	0%	8%
	<i>Question 5: What type of bulbs did the new LED bulbs replace?</i>	65%	24%	0%	12%

Based on survey responses for the 26 participants, ADM estimated a NTGR of 0.69 for the program. This values were multiplied by gross per-unit kWh to derive program net savings [kWh] and net peak demand reduction [kW]. Program NTGR and associated Net savings values are shown in Table 3-28.

Table 3-28 NTGR and Net Impacts for Green Partners Program: Residential - Green Partners

<i>Free Ridership Estimate</i>	<i>NTGR Ratio</i>	<i>Ex Post Net Annual Energy Savings [kWh]</i>	<i>Ex Post Net Peak Demand Reductions [kW]</i>
31%	69%	29,822	1.96

3.3.4. Participant Satisfaction Survey Results

ADM contacted 161 participants of the Green Partners program from which we received 26 responses (16% response rate). The purpose of this survey was focused on collecting data used to determine the net-to-gross ratio; however, additional data was collected to qualify the following:

- Customer awareness of the program;
- Customer purchasing and installation habits; and
- Customer satisfaction with the Green Partners Residential program.

3.3.4.1.1. CFL and LED Installation Rates

Respondents were asked questions about the installation of CFLs and/or LEDs in their homes and the types of light bulbs that were replaced. Many respondents overestimated the number of bulbs they were given through the program. Some had confused the Green Partners program with Million CFLs and had reported the installation of the Million CFL bulbs in the Green Partner Program, while others had confused the Lighting Rebate program with the Green Partners program. For example, one respondent who had purchased 25 LEDs and received a rebate for those bulbs, reported installing them through the Green Partners program. The Evaluator cross-referenced utility data from PY 2014 and PY 2015 to determine if there was overlaps of participant data between programs and program years. This cross reference was used to determine if and where

the potential excess bulbs was spillover from the previous year and from different programs. The programs that were cross reference were the 2014 Residential Green Partners program, 2014 Lighting Rebate program, 2014 RES and ESP programs, 2015 Lighting Rebate program, and 2015 RES and ESP programs. It is likely that there is some confusion between giveaway programs. When estimating the installation rates for the CFLs and LED bulbs, the evaluator used the 2015 program data to determine whether or not they had received bulbs from the program and used deductive reasoning in producing the estimate. For example, if a respondent reported receiving and installing 12 CFLs, but only had received 6 CFLs, it is likely that they installed all 6 CFLs because they had self-reported installing more than the given amount. In other cases, where some respondents had received a specific number of bulbs, but also purchased rebated bulbs and reported installation of all bulbs into the survey, the amount of given bulbs and amount of purchased bulbs were taken into consideration while determining the estimated installation rate. Lastly, some respondents reported installing bulbs that they never received from the Green Partners program. These respondents were given an “NA” since they could not have installed bulbs they did not receive from the program. Evaluators determined the installation rates of CFLs was 83% and LEDs were 74%.

Respondents were also asked about the types of bulbs that were replaced in their homes after receiving the bulbs from the program. Table 3-29 summarizes the responses. A majority of the new CFLs or LEDs replaced incandescent bulbs in the homes.

Table 3-29 Types of Bulbs Replaced

<i>Question</i>	<i>Incandescent</i>	<i>CFLs</i>	<i>LEDs</i>	<i>Don't know</i>
<i>What type of bulbs did the new CFL bulbs replace?</i>	77%	15%	0%	8%
<i>What type of bulbs did the new LED bulbs replace?</i>	65%	24%	0%	12%

3.3.4.1.2. Program Awareness

Respondents were asked several questions regarding their awareness of the program, the likelihood of purchasing more energy efficient bulbs, and financial ability.

Respondents were asked about how they learned about the Green Partners Program. Respondents were allowed to choose more than one source of program awareness which produces more than a total 100%. Most respondents learned about the program from a bill insert (50%) and over a quarter of respondents learned about it at a community event (27%). Figure 3-6 summarizes how respondents learned about the program.

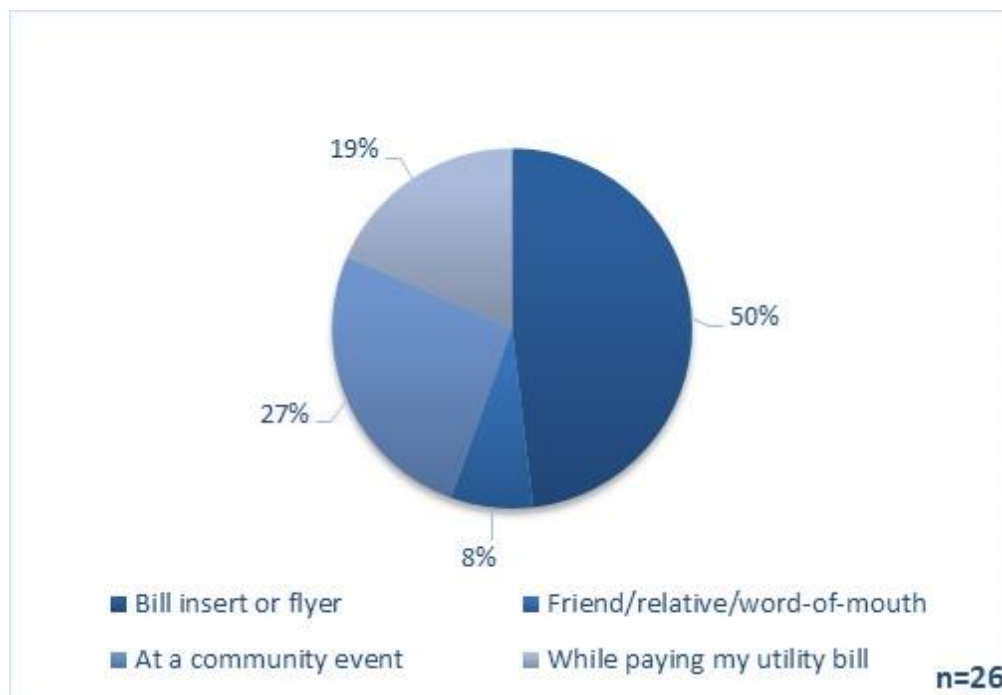


Figure 3-6 Sources of Program Awareness

Prior to learning about the Green Partners program, 23% of respondents already had CFLs and 12% had LED bulbs in their homes. They had as few as one energy efficient bulb to as many as 25 bulbs in their homes prior to the program.

When asked about the likelihood of purchasing CFLs or LEDs outside of the giveaway, only 8% definitely would have purchased the energy efficient bulbs, 35% probably would, while 54% probably would not have and 4% definitely would not have purchased other CFLs. Thirteen respondents did purchase more CFLs and/or LEDs since receiving the free bulbs, and five respondents received a rebate for their purchase. However, 23% of respondents purchased incandescent bulbs within the last year. These respondents were asked to clarify why they had purchased incandescent bulbs, and they replied that they need dimmable bulbs, they were low cost, and bulbs for specific lamps.

3.3.4.1.3. Participant Demographics

Respondents were voluntarily asked to give demographic information. Eighty-eight percent of respondents lived in a single-family home, 8% lived in condominiums, and 4% lived in apartments. Eighty-one percent owned their homes. Approximately, 77% of those homes were between 1,000 and 2,500 square feet and 12% were larger than 2,500 square feet. Over 58% of respondents had one to two people living in the home and 38% had three to five people living in the home. Although 31% of respondents declined to answer their total household income, 27% of respondents fell within an income bracket of making \$70,000 and higher, while 42% making \$50,000 or less.

3.3.4.1.4. Overall Program Satisfaction

Respondents were asked to rate on a scale of 1 to 5, where 1 is “Very Dissatisfied” and 5 is “Very Satisfied”, various program elements. Table 3-30 summarizes these results.

Table 3-30 Overall Program Satisfaction

<i>Program Element</i>	<i>Very Satisfied</i>	<i>Somewhat Satisfied</i>	<i>Neutral</i>	<i>Somewhat Dissatisfied</i>	<i>Very Dissatisfied</i>	<i>Mean Score</i>	<i>Don't Know</i>
The quality of the CFLs/LEDs given	50%	19%	19%	4%	0%	4.25	8%
Service provided by TDPUD staff	96%	0%	0%	0%	0%	5.00	4%
Savings on your electric bill	31%	4%	12%	0%	4%	4.15	50%
Information provided by TDPUD on how to save energy in your home	69%	12%	12%	0%	0%	4.63	8%
Overall program experience	85%	12%	0%	0%	0%	4.88	4%
<i>n = 26</i>							

Overall, respondents were very satisfied with the program. Respondents also reported very high satisfaction with the service provided by utility staff and the information provided by staff on how to save energy in their homes. There was high uncertainty regarding savings on respondents’ electric bills. One respondent said they were dissatisfied with the quality of the CFL because of how long it takes to become bright.

Finally, respondents had comments and suggestions for improvement to the program. Many of the comments were very positive saying that they thought the utility was doing a good job and it was a good program. Examples of some responses received included:

- *“It is a terrific and effective program that helps bring awareness about energy conservation measures by providing actual efficient products that residents can try out. Once they see the value in the product, they will go out and purchase the more of the energy efficient products on their own.”*
- *“This program and the people who manage it are great! We are lucky to have it.”*
- *“I appreciate the efforts and attitude of the people involved in this program. It should generate positive results due to the approach taken to involve the community.”*

3.3.5. Evaluation Findings and Program Recommendations

The following represent ADM’s key findings for the CY 2015 evaluation of the Green Partners program:

- **High Program Installation Rates.** The installation rates were found to be generally high for this program (83% and 74% for CFLs and LEDs respectively) and many of the customers are installing received bulbs upon receipt. The lower

- **High customer satisfaction with the program.** The evaluation found that participants in the Green Partners Program were highly satisfied with the service provided by program staff. However, many respondents were indicated they were unsure of any savings on their utility bill after installing the bulbs.
- **Reduced savings potential for lighting measures.** Application of EISA standards for gross impact baseline reduced unit energy savings from CFL and LED measures relative to last year.
- **Potential for “leakage” outside of TDPUD territory.** There exists a possibility that bulbs given away at community events could end up outside of TDPUD territory given that 1) not all Truckee residents are PUD customers, and 2) many people from communities outside of Truckee attend community events in Truckee.

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Additional follow-up with participants regarding bulb installation.** The reminder can be packaged as a thank you card or email, thanking the customer for their participation and reminding them of the savings they will see post-installation. This delivery mechanism can provide gentle a reminder to customers to install their equipment.
- **Consider labeling on packaging or informational handout.** Many customers were confused about program names and the number of bulbs they were given when answering survey questions. They were unsure of the difference between programs that included energy efficient bulbs. A label on the packaging or an informational handout when they receive the bulbs would help differentiate the program from other lighting programs.
- **Consider surveying customers at give-away events.** Given the potential for bulbs to leak out of PUD territory we recommend that PUD staff survey customers for their electric utility (or location of primary) residence when handing out bulbs. This data can be used to help future events better target PUD customers specifically.

3.4. Residential – Appliance

Table 3-31 Residential - Residential-Appliance: Summary Table

Final Project Count:	391
Ex Post Net Energy Savings [kWh]:	77,345
Ex Post Net Demand Savings [kW]:	8.8
Ex Post Net Gas Savings [Therms]:	2,648
Total Resource Cost [\$ / kWh]:	\$0.07
Net-To-Gross Ratio:	78%
Program Contribution to Portfolio:	5%
General EM&V Approach	Desk Review

The Appliance Rebate Program encourages customers to purchase energy efficient appliances by providing increasing incentives for more efficient appliances as identified by Energy Star and the Consortium of Energy Efficiency (CEE). Energy Star and CEE Tier 1 identify appliances that use less energy than the federal standard. CEE Tiers 2 & 3 identify super-efficient appliances that use significantly less energy than the federal standard and identify the most energy efficient of the Energy Star spectrum.

3.4.1. Gross Impact Evaluation Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = UES_{kWh} * N$$

$$kW_{Sav} = \frac{kWh_{Sav}}{8760}$$

Where:

- kWh_{Sav} Are the annual energy impacts for the project
- kW_{Sav} Are the peak demand reductions
- UES_{kWh} Is the unit energy savings estimate for the measure
- N Is the number of rebated units

UES values for this program were derived from the CMUA TRM. The final values used for this evaluation are listed in Table 3-32.

Table 3-32 List of UES Estimates: Appliance Rebates

Equipment	UES (kWh/Unit)
ES/CEE Tier 1 Clothes Washer	209
ES/CEE Tier 2 Clothes Washer	220
ES/CEE Tier 3 Clothes Washer	229
ES/CEE Tier 1 Dishwasher	39
ES/CEE Tier 1 Refrigerator	130
ES/CEE Tier 2 Refrigerator	162
ES/CEE Tier 3 Refrigerator	195

3.4.2. Net Impact Methods and Results

Net impacts were not reviewed directly for this program. The applied NTG ratio was derived from the PY 2014 evaluation report for this program. Table 3-33 lists the NTG ratios for each appliance. These values were multiplied by gross per-unit kWh to derive program net savings [kWh] and net peak demand reduction [kW]. Program NTGR and associated Net savings values are shown in Table 3-33.

Table 3-33 NTGR and Net Impacts for Appliance Rebate Program

Measure	Free Ridership Estimate	NTGR Estimate (1-FR)	Ex Post Net Annual Energy Savings [kWh]	Ex Post Net Peak Demand Reductions [kW]	Ex Post Net Gas Savings [Therms]
Clothes Washer	21%	79%	51,785	5.91	2,072
Dishwasher	25%	75%	851	0.10	20
Refrigerator	27%	73%	7,782	0.89	-

3.4.3. Evaluation Findings and Program Recommendations

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Emphasize application deadline on program materials.** Some respondents were unhappy with the application deadline because the time period was “too short” and would have appreciated a reminder. Emphasizing the deadline on the materials may help encourage more customers to participate in the future.
- **Increase cross-promotion of other TDPUD residential programs.** Although many customers received rebates for the appliances, they may be unaware of the full portfolio of residential programs TDPUD offers.
- **Consider ECM Furnace fan measure.** Currently, furnaces in the highest efficiency brackets utilize multi-speed ECM fan motors to achieve such efficiency levels. Given Truckee’s heating dominated climate, this represents a decent

energy savings potential. In particular, we recommend that TDPUD reach out to Southwest gas to see if a partnership could be established on their existing furnace rebates. TDPUD could contribute a negotiated percentage to the rebate. This would also carry the advantage of joint marketing to PUD customers.

3.5. Residential – Energy Saving Partners Program

Table 3-34 Residential - ESP Residential Survey: Summary Table

Final Project Count:	44
Ex Post Gross Energy Savings [kWh]:	17,920
Ex Post Gross Demand Savings [kW]:	1
Ex Post Gross Gas Savings [Therms]:	2,690
Ex Post Gross Water Savings [CCF]:	7.54
Total Resource Cost [\$ / kWh]:	\$0.21
Net-To-Gross Ratio:	100%
Program Contribution to Portfolio:	1%
General EM&V Approach	Option A
Survey Sample Size	7

The TDPUD provides residential energy surveys to qualified income-limited customers through the Energy Saving Partners (ESP). All residential energy surveys include a free energy survey and free energy and water-saving measures. The energy survey is a visual inspection only. Income-limited customers are qualified by an intermediary agency who will pre-qualify applicants for this program. Any measures recommended during the survey, which the District is providing for the program, are given to the residents at the time of survey. Customers are responsible for installing these free measures within 10 days of the receipt of these measures. Beginning in 2013 the energy surveyor will install up to 24 compact fluorescent light bulbs (CFL) and 2 low-flow shower heads for the customer with their permission and dependent upon time available within the scheduled survey. Customers are also informed of District programs that they may benefit from and provided with associated literature. ESP program participants are eligible for a one-time credit per service address equal to their highest energy charge in the past 12-months not to exceed \$200. If they do not have 12-month of billing history, District may use the prior 12-month energy usage history for the service address. Customers who have received an ESP credit, but have moved to a new service address are eligible for a credit and survey at the new address 2 years after the initial credit. 2009 program participants are eligible for a second credit and survey at the same address as the original survey. ESP qualifications guidelines are consistent with the Nevada County Low-Income criteria, other local low income organization criteria (food stamps, MediCal) or proof of 25% or greater loss of household income due to change in employment status. Second home owners (non-permanent resident rate) do not qualify.

3.5.1. Sampling Methodology

For programs with relatively homogenous measures, ADM conducted a simple random sample of participants. Specifically, ADM chose participants with email addresses to conduct an online survey. ADM contacted 24 participants out of the total participants of the ESP program.

3.5.2. Gross Impact Evaluation Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{sav} = UES * N$$

$$kW_{sav} = UES * N$$

Where:

- kWh_{sav} Are the annual energy impacts for the project
- kW_{sav} Are the peak demand reductions
- UES Is the Unit energy savings estimate for the measure
- N Is the number of measures implemented

Several measures were offered through this program. ADM also observed that various combinations/quantities of each were implemented among program participants. ADM developed UES estimates for each measure as listed in Table 3-35.

Table 3-35 List of UES estimates for Measures offered in ESP Program

Measure	Savings Per [kWh]		Savings Per [kW]	
	No Hot Water	W/ Hot Water		No Hot Water
DR30 15/65	27	27	DR30 15/65	27
Globe G25 9/40	18	18	Globe G25 9/40	18
PAR 38 120/23	61	61	PAR 38 120/23	61
R20 14/50	22	22	R20 14/50	22
R30 15/65	27	27	R30 15/65	27
Spiral 13/60	26	26	Spiral 13/60	26
Spiral 23/100	61	61	Spiral 23/100	61
LED A19	29	29	LED A19	29
Swivel Aerators	2.51	44.06	Swivel Aerators	2.51
Bathroom Aerators	2.51	44.06	Bathroom Aerators	2.51
Kitchen Aerators	10.30	219.17	Kitchen Aerators	10.30

The assumptions and sources used to develop each of the UES estimates in Table 3-35 can be found in the Excel workbook used to analyze the program’s impacts. This workbook can be made available to TDPUD upon request.

3.5.3. Net Impact Methods and Results

Industry best practices state that low-income programs are deemed 100% for NTGR. ADM applied the associated net-to-gross ratios (NTGRs) for this program based on industry best practices. These values were multiplied by gross per-unit kWh. Net savings values are shown in Table 3-36.

Table 3-36 NTGR and Net Impacts for Energy Savings Partners Program

Free Ridership	NTG Ratio	Ex Post Net Annual Energy Savings [kWh]	Ex Post Net Peak Demand Reductions [kW]	Ex Post Net Gas Savings [Therms]	Ex Post Net Water Savings [CCF]
0.00	1.00	17,920	1.0	2,690	7.54

3.5.4. Participant Satisfaction Survey Results

ADM contacted 24 participants of the Energy Saving Partners program from which we received 7 total responses (29.2% response rate). The purpose of this survey was focused on collecting data used to determine the net-to-gross ratio; however, additional data was collected to qualify the following:

- Customer awareness of the program;

- Surveyor satisfaction;
- Installation rates; and
- Customer satisfaction with the Energy Saving Partners program.

3.5.4.1. Program Awareness

Respondents were asked how they learned about the ESP program and were asked to indicate all the ways they had learned about the program which equates to more than 100%. Figure 3-7 summarizes how respondents learned about the program. The most common way respondents learned about the program was through word-of-mouth (28.6%) while others learned about the program through a bill insert (28.6%).

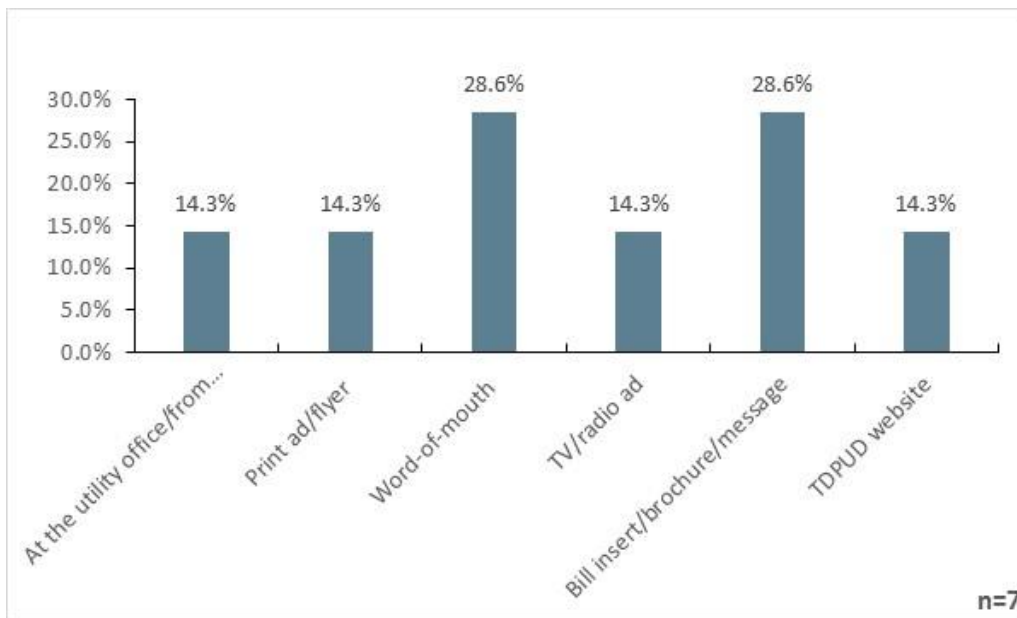


Figure 3-7 Sources of Program Awareness

3.5.4.2. Participant Decision-Making Processes

Respondents were asked several questions regarding their decision-making processes including why they chose to participate in the program, prior planning, financial ability, and likelihood to install the free devices without the program. Respondents were asked to indicate all reasons why they chose to participate in the program and then report which of those reasons was most important. The most frequent answer was a reduction to their utility bill (100%) followed by wanting to save energy (71%). The most important reason respondents chose to participate in the program was to reduce their utility bill (71%). Figure 3-8 summarizes these results.

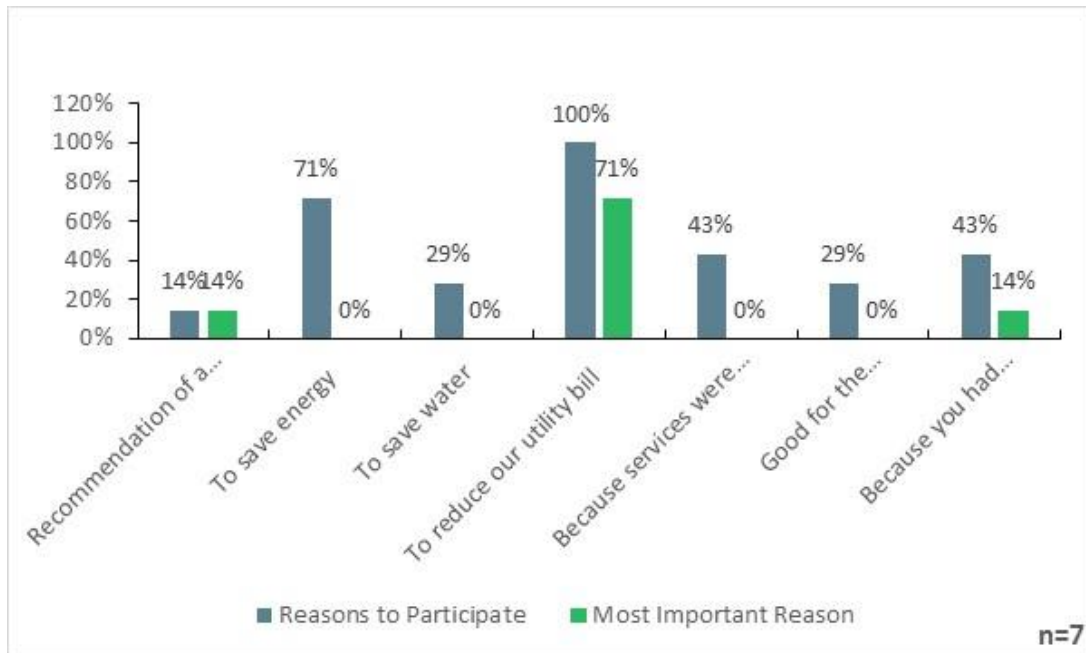


Figure 3-8 Reasons for Participation

Fifty-seven percent of respondents indicated that they did not have existing plans to make improvement on their homes prior to learning about the program. Fifty-seven percent of respondents stated that they were unlikely to have installed the same home improvements without assistance from the program and the remaining would not have installed these measures without the program. All respondents indicated that they would have not been financially able to make the home improvements without the incentives from the utility.

3.5.4.3. Measure Installation Rates and Satisfaction

Respondents were initially asked what measures were installed in their homes and then answered questions regarding the survey and installation work done in their homes by the surveyor. They were also asked whether they had removed any of the fixtures and to clarify why they had been removed. Participants could receive these direct install fixtures:

- CFLs;
- LEDs;
- Low flow showerheads;
- Kitchen, bathroom, and/or swivel aerators;
- Hose spray nozzle;
- Weather-stripping;
- A door sweep;

- Pipe, elbow and/or tee insulation;
- Water heater jacket; and
- A toilet leak detection kit.

Table 3-37 shows the installation rates calculated by the Evaluators and based on the survey respondents.

Table 3-37 Measure Installation Rates

Measures	Installation Rate	N
CFL	67%	4
LED	100%	2
Low Flow Shower Head	83%	6
Kitchen/Bathroom/ Swivel Aerator	75%	4
Hose Spray Nozzle	None reported	0
Weatherstripping	100%	2
Door Sweep	100%	2
Pipe/Elbow/ Tee Insulation	None reported	0
Water Heater Jacket	None reported	0

3.5.4.3.1. CFLs

Four respondents reported having CFLs installed in their homes. The number of bulbs installed ranged from two to six bulbs. One respondents had the surveyor install some or all of their CFL bulbs, and rated the surveyor satisfactory (4.00 out of 5). Respondents rated their satisfaction of the CFLs with a mean score of 4.33 (out of 5) and half of respondents said that the quality of the CFLs were higher quality than the bulbs they had installed previously. Two respondents said they had removed some of the bulbs in their homes. These respondents clarified that they did not like the CFLs or removed the CFLs to replace them with LEDs.

3.5.4.3.2. LEDs

Two respondents reported having LEDs installed in their homes. Both respondents had the surveyor install some or all of their LED bulbs, and rated the surveyor’s work with high satisfaction (5 out of 5). Respondents rated their satisfaction of the LEDs with a mean

score of 5 (out of 5), and most respondents said that the quality of the LEDs were either the same or higher quality than the bulbs they had installed previously. None of the bulbs have been removed in their homes.

3.5.4.3.3. *Showerheads*

Six respondents reported having showerheads installed in their homes. Sixty-seven percent of the respondents had one showerhead installed while the remaining had two installed. Half of the respondents had the surveyor install some or all of the showerheads, and rated the surveyor's work satisfactory (4.33 out of 5). Respondents rated their satisfaction of the showerheads with a mean score of 2.80 (out of 5), which indicates fairly low satisfaction. However, none of the respondents have removed the showerheads.

3.5.4.3.4. *Aerators*

Four respondents reported having aerators installed in their homes. Fifty percent of respondents had one aerator installed in their home and 50% percent had two aerators installed. Fifty percent of respondents had the surveyor install some or all of the aerators, and rated the surveyor's work with fair satisfaction (2.50 out of 5). Respondents rated their satisfaction of the aerators with a mean score of 3.00 (out of 5). One respondent removed two aerators because they did not have enough flow and they did not like the spray.

3.5.4.3.5. *Hose Spray Nozzles*

None of the respondents reported receiving this measure.

3.5.4.3.6. *Weather-stripping*

Three respondents reported having weather-stripping installed in their homes. One respondent had the surveyor install some or all of the weather-stripping, and rated the surveyor's work satisfactory (4.00 out of 5). Respondents rated their satisfaction of the weather-stripping with a mean score of 2.5 (out of 5). However, none of the respondents have removed any weather-stripping.

3.5.4.3.7. *Door Sweeps*

Two respondents reported having a door sweep installed in their homes. Both of the respondents self-installed the door sweep. Respondents rated their satisfaction of the door sweep with a mean score of 4 (out of 5). None of the respondents have removed the door sweep.

3.5.4.3.8. *Insulation*

None of the respondents reported receiving this measure.

3.5.4.3.9. *Water Heater Jackets*

None of the respondents reported receiving this measure.

3.5.4.4. *Surveyor Satisfaction*

Respondents were asked questions about installation quality, professionalism, and experience with the surveyor. All of the respondents thought that surveyor was professional and knowledgeable. Overall, respondents rated the surveyor with a high satisfaction mean score of 4.8 out of 5.

3.5.4.4.1. *Participant Demographics*

Respondents were voluntarily asked to give demographic information. Fifty-seven percent of respondents lived in a single-family home while the remaining lived in condominiums. Forty-three percent owned their homes and the remaining rented. Approximately, 57% of those homes were between 1,000 and 2,500 square feet, 14% were larger than 2,500 square feet, and 29% were smaller than 1,000 square feet. Seventy-one percent of respondents had one to two people living in their home and 19% had three to five people living in the home.

3.5.4.5. *Overall Program Satisfaction*

Respondents were asked to rate several program elements on a scale of 1 to 5, where “5”; is very satisfied and “1” is very dissatisfied. Table 3-38 summarizes respondents’ satisfaction towards each element.

Table 3-38 Residential Survey Participant Satisfaction

<i>Element of Program Experience</i>	<i>Very Satisfied</i>	<i>Somewhat Satisfied</i>	<i>Neutral</i>	<i>Somewhat Dissatisfied</i>	<i>Very Dissatisfied</i>	<i>Score</i>	<i>Don't Know</i>
Information provided by the surveyor	71%	14%	14%	0%	0%	4.57	0%
The quality of installation work by the surveyor	57%	29%	0%	0%	0%	4.67	14%
The savings on your monthly bill	43%	0%	0%	0%	29%	3.40	29%
The service provided by utility staff	71%	14%	14%	0%	0%	4.57	0%
Information provided by TDPUD on how to reduce your utility bill	57%	14%	14%	0%	14%	4.00	0%

<i>Element of Program Experience</i>	<i>Very Satisfied</i>	<i>Somewhat Satisfied</i>	<i>Neutral</i>	<i>Somewhat Dissatisfied</i>	<i>Very Dissatisfied</i>	<i>Score</i>	<i>Don't Know</i>
Improvement in home comfort after receiving the home improvements	14%	43%	29%	0%	0%	3.83	14%
Overall program experience	57%	0%	43%	0%	0%	4.14	0%

Overall, respondents are satisfied with the Energy Saving Partners Program. Respondents had scored program elements with highest satisfaction included the quality of work by the surveyor (4.67), information provided by the surveyor (4.57), and the service provided by utility staff (4.57).

The program element that scored the lowest was the savings on the monthly bill. Many respondents said they did not notice a difference in their bill or that they were still waiting to see a difference on their bill. However, respondents have noticed a difference in their water bill (57%), and some respondents saw a difference in both bills (14%).

3.5.5. Evaluation Findings and Program Recommendations

The following represent ADM's key findings for the CY 2015 evaluation of Energy Saving Partners program:

- **Good customer satisfaction with the program.** The evaluation found that participants in the ESP Program were highly satisfied with the program surveyor and their interactions with program staff.
- **Participants report high levels of satisfaction with their surveyor.** Many of the participants were greatly appreciative of the information provided by their surveyor.
- **Reduced savings potential for lighting measures.** Application of EISA standards for gross impact baseline reduced unit energy savings from CFL and LED measures relative to last year.

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Additional follow-up with participants regarding measure installations.** For those that choose to self-install rather than have the surveyor install on-site, send a reminder to participants to install the measures. The reminder can be packaged as a thank you card, thanking the customer for their participation and reminding

them of the savings they will see with full installation of the kit. This delivery mechanism can provide gentle a reminder to customers to install their equipment.

- **Increase cross-promotion of other TDPUD residential programs.** The majority of customers reported hearing about TDPUD's programs through program staff. Since program staff are already present to provide the energy survey this represents a good opportunity to directly inform customers about TDPUD's other programs. Although many customers received rebates for other appliances, they may be unaware of the full portfolio of residential programs TDPUD offers.
- **Increase offerings of LED lighting.** As LED lighting costs continue to drop and their consistency in quality increases the measure is becoming much more cost effective.

3.6. Residential - Lighting Rebate

Table 3-39 Residential Lighting Rebate: Summary Table

Final Project Count:	179
Ex Post Gross Energy Savings [kWh]:	49,263
Ex Post Gross Demand Savings [kW]:	3.2
Total Resource Cost [\$/kWh]:	\$0.03
Net-To-Gross Ratio:	62%
Program Contribution to Portfolio:	4%
General EM&V Approach	Option A
Survey Sample Size	55

The TDPUD Residential Lighting Rebate Program encourages customers to replace incandescent and halogen light bulbs with energy efficient lighting by providing incentives for Compact Fluorescent (CFL) and Light Emitting Diode (LED) screw-in or plug in bulbs.

3.6.1. Sampling Methodology

For programs with relatively homogenous measures, ADM conducted a simple random sample of participants. Specifically, ADM chose participants with email addresses to conduct an online survey. ADM contacted 108 participants out of the total participants of the Lighting Rebate program.

3.6.2. Gross Impact Evaluation Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = (kW_{Base} - kW_{CFL}) * Hrs * HCIF * ISR$$

$$kW_{Sav} = (kW_{Base} - kW_{CFL}) * CDF * HCIF * ISR$$

Where:

- kWh_{Sav} Are the annual energy impacts for the project
- kW_{Sav} Are the peak demand reductions
- kW_{Base} Is the connected load of the baseline light bulb⁹

⁹ Assessed using an assumed baseline wattage based on the wattage/type of the installed bulb and further informed through surveys

kW _{CFL}	Is the connected load of the installed light bulb ¹⁰
Hrs	Are the annual hours of operation
HCIF	Heating/Cooling Interactive Factor ¹¹
CDF	Is the Coincident Demand Factor
ISR	Is the <i>In-Service Rate</i>

Due to similarities between this program and the Green Partners program, as well as the small size of this program relative to the others, ADM leveraged our findings from the Green Partners program to inform the assumptions used to estimate gross impacts for the Lighting Rebate Program. Annual Hours of use were used per Table 3-22, the CDF and HCIFs were used from DEER, and per bulb energy savings estimates were determined and applied.

3.6.3. Net Impact Methods and Results

In addition to gross savings, ADM estimated associated net-to-gross ratios (NTGRs) for this program based on results from a participant survey. The net-to-gross analysis for the Lighting Rebate program was conducted using the methodologies outlined in 2.1.1.1. Determining the net effects of the lighting discounts requires estimating the percentage of energy savings from efficient lighting purchases that would have occurred without program intervention. These questions corresponded with financial ability to purchase the equipment, timing of program awareness, likelihood of purchase without the incentive, and timing of the purchase.

For residential programs, free-ridership is calculated as the average score determined for the sample of participants surveyed. Survey responses were scored based on the survey answers and the type of unit they purchased. These responses fell into one of three categories of what the customer would have installed without the availability of the rebate versus what they installed with the rebate. These factors, along with the survey questions used to address them are provided in Table 3-40.

¹⁰ Based on the records kept in the tracking system and further informed by the surveys

¹¹ Per DEER 2013 for appropriate building type

Table 3-40 List of Net-To-Gross Factors and Questions Addressing Them: Lighting Rebate

#	Factor	Description	Question Used in Survey
1	Prior Experience	If the customer answers “LED”, they are assigned 100% free-ridership. If the customer answers “Incandescent”, “CFL”, or “Mix/Other”, customers are asked a follow-up question (Q2).	<p>Q10: Now I would like you to think about the types of bulbs the CFLs replaced. Did they replace typical incandescent light bulbs, old CFL light bulbs, some other type of existing bulb, or a combination of old bulb types?</p> <p>OR</p> <p>Q11: Now I would like you to think about the types of bulbs the LEDs replaced. Did they replace typical incandescent light bulbs, old LED light bulbs, some other type of existing bulb, or a combination of old bulb types?</p>
2	Behavior without the Discount	If the customer answers “Probably not” or “Definitely not”, then the customer is considered to have not been planning to purchase any of the measures and is 0% free-rider.	Q17: If the rebate incentives were not available, how likely would you have been to purchase the CFLs or LEDs bulbs?
3	Importance of Program (Mitigating Factor)	<p>If the customer provided an answer of “Don’t know” for their awareness of the discount, they were assigned “No Change.”</p> <p>If the customer answers “5”, meaning “Very important”, they were assigned Full Mitigation; If the customer answers “4”, they were assigned Partial Mitigation; anything less than “3” was assigned “No change.”</p>	<p>Q14: How did you become aware of the TDPUD lighting discounts?</p> <p>Q18: On a scale of 1 to 5, where 1 is “not important at all” and 5 is “very important,” how important was the TDPUD lighting discount to your decision to purchase those specific light bulbs?</p>

Table 3-41 through Table 3-44 summarizes the responses to questions addressing free-ridership for the 2015 Lighting Rebate Program.

Table 3-41 Prior Experience Results: CFL Lighting

<i>Factor</i>	<i>Question</i>	<i>Incandescent</i>	<i>CFLs</i>	<i>LEDs</i>	<i>Mix/Other</i>
Prior Experience	Q10: Did they replace typical incandescent light bulbs, old CFL light bulbs, some other type of existing bulb, or a combination of old bulb types?	80%	16%	0%	0%

Table 3-42 Prior Experience Results: LED Lighting

<i>Factor</i>	<i>Question</i>	<i>Incandescent</i>	<i>CFLs</i>	<i>LEDs</i>	<i>Mix/Other</i>
Prior Experience	Q11: Did they replace typical incandescent light bulbs, old LED light bulbs, some other type of existing bulb, or a combination of old bulb types?	58%	38%	1%	1%

Table 3-43 Behavior without the Discount Results: Lighting Rebate

<i>Factor</i>	<i>Question</i>	<i>Definitely</i>	<i>Probably</i>	<i>Probably not</i>	<i>Definitely not</i>
Behavior without the Discount	Q17: If the rebate incentives were not available, how likely would you have been to purchase the CFLs or LEDs bulbs?	13%	40%	44%	4%

Table 3-44 Importance of Program Results: Lighting Rebate

<i>Factor</i>	<i>Question</i>	<i>Provided Answer</i>	<i>Don't know</i>	5	4	3	2	1
Importance of Program (Mitigating Factor)	Q14: How did you become aware of the TDPUD lighting discounts?	97%	3%	-	-	-	-	-
	Q18: On a scale of 1 to 5, where 1 is “not important at all” and 5 is “very important,” how important was the TDPUD lighting discount to your decision to purchase those specific light bulbs?	-	-	51%	29%	7%	5%	2%

Based on survey responses for the 55 participants, ADM estimated a NTGR of 0.62 for the program. This values was multiplied by gross per-unit kWh to derive program net savings [kWh] and net peak demand reduction [kW]. Program NTGR and associated Net savings values are shown in Table 3-45.

Table 3-45 NTGR and Gross Impacts for Lighting Rebate Program: Lighting Rebate

<i>Installation Rate</i>		<i>NTG Ratio</i>	<i>Ex Post Gross Annual Energy Savings [kWh]</i>	<i>Ex Post Gross Peak Demand Reductions [kW]</i>
CFLs	83%	62%	49,263	3.2
LEDs	85%			

3.6.4. Participant Satisfaction Survey Results

ADM contacted 108 participants of the Lighting Rebate program via online survey from which we completed 55 responses (50.9% response rate). The purpose of this survey was focused on collecting data used to determine the net-to-gross ratio; however, additional data was collected to qualify the following:

- Customer awareness of the program;
- Customer bulb purchase and installation habits; and
- Customer satisfaction with the Lighting Rebate program.

3.6.4.1.1. Installation Rates

Respondents were asked several questions about the installation of CFLs and/or LEDs in their homes and the types of light bulbs that were replaced. Respondents were asked how many bulbs they had purchased, installed, or saved to install at a later time. Respondents, who claimed purchasing CFLs, had purchased between one and 30 bulbs and one respondent had purchased 80 bulbs, and other respondents, who claimed purchasing LEDs, had purchased between one and 60 bulbs, and one respondent claimed to purchase almost 100 LED bulbs. ADM calculated the installation rates for the CFLs as 83% and LEDs as 85%. Respondents were asked why they had purchased CFLs and/or LEDs, and asked to follow up with why they chosen to purchase that type of bulb (CFL or LED) rather than another type of bulb. Table 3-46 through

Table 3-49 summarizes the participants' motivations for choosing to purchase energy efficient bulbs. The most common reason respondents purchased the energy efficient bulbs was because they wanted to lower their energy usage (70% and 78%, respectively). Conversely, those participants who purchased LED bulbs stated that the "good deal" on the bulbs prompted the purchase (55%).

Table 3-46 Reasons Participants Purchased CFLs

Why did you purchase the CFLs?	Response
Replaced burned out bulbs	40%
Replace working bulbs, wanted to lower energy usage	70%
Installed in a new light fixture or lamp socket	15%
Improve lighting quality/brighten a room	5%
Replaced burned out bulbs & working bulbs at same time	25%
Stock up on bulbs	25%
Good deal prompted purchase	25%
Other	5%
Don't know	0%

Table 3-47 Motivations to Purchase CFLs

Why did you decide to purchase CFL bulbs instead of another type of bulb, such as an LED bulb?	Response
CFLs were the cheapest option	30%
CFLs were the only bulb type available at the store	10%
CFLs were the closest match to the bulb I was replacing	35%
I saw the CFLs first	15%

I prefer the lighting quality of CFLs	0%
I prefer the features associated with CFLs, such as dimming, instant on, color change, smart controls, etc.	10%
CFLs last longer than other bulbs	15%
Other	20%
Don't recall	15%

Respondents indicated that they had decided to purchase CFLs because it was the closest match to the bulb that was being replaced (35%) and followed closely by CFLs were a cheaper option (30%).

Table 3-48 Reasons Participants Purchased LEDs

Why did you purchase the LEDs?	Response
Replaced burned out bulbs	20%
Replace working bulbs, wanted to lower energy usage	78%
Installed in a new light fixture or lamp socket	18%
Improve lighting quality/brighten a room	39%
Replaced burned out bulbs & working bulbs at same time	20%
Stock up on bulbs	2%
Good deal prompted purchase	55%
Other	10%
Don't know	0%

Table 3-49 Motivations to Purchase LEDs

Why did you decide to purchase LEDs instead of another type of bulb, such as a CFL or incandescent bulb?	Response
LEDs were the cheapest option	0%
LEDs were the only bulb type available at the store	0%
LEDs were the closest match to the bulb I was replacing	6%
I saw the LEDs first	0%
I prefer the lighting quality of LEDs	51%
I prefer the features associated with LEDs such as dimming, instant on, color change, smart controls, etc.	55%
LEDs last longer than other bulbs	65%
Other	27%
Don't recall	2%

Respondents indicated that they had decided to purchase LEDs because of the bulbs' longevity (65%) followed closely by the features associated with LEDs (55%).

3.6.4.1.2. Light Bulb Characteristics

Respondents were asked several questions regarding characteristics they consider when purchasing light bulbs. When respondents were initially asked about the important characteristics when purchasing the bulbs, they were allowed to choose more than one characteristic. The most frequently cited characteristic when purchasing bulbs is energy efficiency (28%), and the most important characteristic for bulb purchase was also energy efficiency (58%). Other respondents indicated some importance in characteristics like cost and longevity (60%) as well as brightness (53%). Table 3-50 shows other important characteristics participants consider when choosing an energy efficient bulb.

Table 3-50 Important Bulb Characteristics: Lighting Rebate

<i>Bulb Characteristic</i>	<i>% Indicated</i>	<i>% Indicated Most Important</i>
Cost	60%	13%

Energy Efficiency	89%	58%
Color/style	49%	11%
Brightness	53%	7%
Brand	4%	0%
Longevity	60%	9%
Other	9%	2%
	n=55	n=55

Seventy-five percent of respondents stated that the energy efficiency of light bulbs they select for purchase is very important to their decision-making process.

3.6.4.1.3. Awareness of the Discounts

Respondents were asked several questions regarding their awareness of the program incentives, and more specifically about how they learned about the program, the ability to recall the discount, financial ability to purchase the bulbs, the likelihood of purchase, and the importance of the program discount.

First, respondents were asked to recall if they saw any discounted products in the last six months. Fifty-one percent of respondents recalled seeing a discount on the energy efficient bulbs. Those respondents were asked a follow-up question about which retailers they recalled offering discounts; many of the respondents said they saw discounts at major retailers like Home Depot, ACE Hardware, and Costco, the local hardware store (Mountain Hardware), and through local utilities (TDPUD, SMUD, PG&E, NV Energy).

Next, they were asked about where they learned about the Lighting Rebate program. Respondents most frequently answered that they learned about the program from the utility website (30%) followed closely by utility program staff (29%). Table 3-51 summarizes how respondents learned about lighting discounts.

Table 3-51 Program Sources of Awareness: Lighting Rebate

<i>Potential Sources of Awareness</i>	<i>% Indicated</i>
In-store promotional event representative	0%
In-store signage/marketing materials	1%
Store salesperson	0%
TDPUD website	30%
TDPUD Program Staff	29%

Word of mouth	14%
Bill Insert	14%
Other	9%
Don't know	3%

Sixty-nine percent of respondents said they would have been financially able to purchase the energy efficient bulbs while 22% would not have been financially able. Table 3-52 tabulates the likelihood of energy efficient bulb purchase without the rebate.

Table 3-52 Likelihood of Purchase

<i>Question</i>	<i>Definitely</i>	<i>Probably</i>	<i>Probably not</i>	<i>Definitely not</i>
Q17: If the rebate incentives were not available, how likely would you have been to purchase the CFLs or LEDs bulbs?	13%	40%	44%	4%

Eighty percent of respondents stated that the lighting discount was important in their decision to purchase the specific bulbs.

3.6.4.1.4. Participant Demographics

Respondents were voluntarily asked to give demographic information. Ninety-three percent of respondents lived in a single-family home while the remaining lived in condominiums. Ninety-eight percent owned their homes. Approximately, 73% of those homes were between 1,000 and 2,500 square feet, 22% were larger than 2,500 square feet, and 4% were smaller than 1,000 square feet. Almost 50% of respondents had two people living in their home and 25% had three to five people living in the home. Although 35% of respondents declined to answer their total household income, 55% of respondents fell within an income bracket of making \$70,000 and higher, and only 11% making \$50,000 or less.

3.6.4.1.5. Overall Satisfaction

Many respondents expressed great appreciation for the program and hope that the program continues in the future. Some respondents replied:

- *“I think the program is great. I outfitted our house with LEDs due to your program.”*
- *“It was a great motivator for me to switch out for more efficient lighting. The PUD staff was extremely helpful and encouraging.”*

- *“It’s an excellent program that got us moving to replace old bulbs with LED bulbs.”*

3.6.5. Evaluation Findings and Program Recommendations

The following represent ADM’s key findings for the CY 2015 evaluation of the Lighting Rebate program:

- **Participants want to buy energy efficient light bulbs.** Fifty-eight percent of respondents stated that the energy efficiency of light bulbs was the most important characteristic when selecting lighting, and seventy-five percent of respondents stated that the energy efficiency of light bulbs they select for purchase is very important to their decision-making process. Many stated their reason to purchase energy efficient bulbs was to lower their energy usage.
- **Participants learned about the program from the utility.** Many respondents indicated that learned about the program from the utility website and utility program staff.
- **Reduced savings potential for lighting measures.** Application of EISA standards for gross impact baseline reduced unit energy savings from CFL and LED measures relative to last year.

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Emphasize application deadline on program materials.** Some respondents were unhappy with the application deadline because the time period was “too short” and would have appreciated a reminder. Emphasizing the deadline on the materials may help encourage more customers to participate in the future.

3.7. Residential - Toilet Exchange

Table 3-53 Residential -Toilet Exchange: Summary Table

Final Project Count:	247
Ex Post Gross Energy Savings [kWh]:	9,695
Ex Post Gross Demand Savings [kW]:	1.1
Ex Post Gross Water Savings [CCF]:	1,180
Total Resource Cost [\$ /kWh]:	\$1.05
Net-To-Gross Ratio:	90%
Program Contribution to Portfolio:	1%
General EM&V Approach	Desk Review

The Water Efficient Toilet Exchange Program encourages customers to replace high-water use toilets (greater than or equal to 3 gallons per flush) to low water use toilets by distributing low-flush toilets (1.28 gallons per flush) through a local vendor store front. The vendor provides, at their store, year-round at least two low-flush toilet options (round and oblong) to qualifying customers to exchange at no cost. The vendor is responsible for collecting and verifying eligibility of the old toilet, properly disposing of the old toilets, and providing monthly program reports documenting the District customers served, quantity of toilets provided and vendor invoice. The District verifies the customer’s eligibility to participate in the program and provides them with an approved District Water-Efficient Toilet Exchange Program Customer Information Form.

3.7.1. Gross Impact Evaluation Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{sav} = UES * N$$

$$kW_{sav} = \frac{kWh_{sav}}{8760}$$

Where:

- kWh_{sav} Are the annual energy impacts for the project
- kW_{sav} Are the peak demand reductions
- UES Is the per unit energy savings estimate for each measure.
- N Is the number of measures implemented

Three separate UES estimates were derived based on the capacity of the toilet installed and on the toilet it replaced. ADM used engineering calculations to derive the unit energy

savings estimates along with secondary literature research to establish appropriate assumptions. The following formula was used to estimate the UES;

$$kWh_{Toilet} = F_{Person-Day} * N_{Persons} * (V_{Base} - V_{Post}) * 365 * \gamma$$

Where:

- kWh_{Toilet} Are the annual energy impacts for the retrofit
- F_{Person-Day} Is the number of flushes per person per day
- V_{Base/Post} Is the volume of water consumed per flush by baseline and post toilets.¹²
- γ Is the embedded energy content of water flushed

Final values for each of the three toilet volume combinations offered through the program are listed in Table 3-54.

Table 3-54 List of UES estimates for Each Toilet Volume Represented in the Program: Toilet Exchange/Rebate

<i>Measure</i>	<i>Gross Energy Impacts [kWh/Toilet]</i>	<i>Gross Water Impacts [Gal/Toilet]</i>
Toilet 1.6 GPF to 1.28 GPF/Dual-Flush	7	665
Toilet 3 GPF to 1.28 GPF/Dual Flush	39	3,575
Toilet 3 GPF to 1.6 GPF	32	2,910

3.7.2. Net Impact Methods and Results

As this program is implemented by a third party, and is nearly identical to the Toilet Rebate program, the net-to-gross ratio for the rebate program was used from the PY 2014 Evaluation. The Net-To-Gross rate applied to this program, and final net impacts are shown in Table 3-55.

¹² The embedded energy content of water was assumed to be .0047 kWh/Gal based on two years data on TDPUD's water distribution. Note that this is a conservative estimate as it does not include the cost of water conveyance through Truckee Sanitary District or the cost of processing at the Tahoe Truckee Sanitation Agency waste-water treatment plant. A study is currently on-going to establish final values for these additional components.

Table 3-55 Summary of NTG Ratio and Gross Impacts: Toilet Exchange Program

<i>Free Ridership Estimate</i>	<i>NTG Ratio</i>	<i>Ex Post Gross Annual Energy Savings [kWh]</i>	<i>Ex Post Gross Peak Demand Reductions [kW]</i>	<i>Ex Post Gross Gallons [CCF]</i>
10%	90%	9,9695	1.1	1,180

3.7.3. Evaluation Findings and Program Recommendations

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Increase cross-promotion with Toilet Rebate program.** Customers who participate in the Toilet Exchange program should be encouraged to participate in the Toilet Rebate program.
- **Increase cross-promotion of other TDPUD residential programs.** Although many customers received rebates for other appliances, they may be unaware of the full portfolio of residential programs TDPUD offers.

3.8. Residential - Toilet Rebate

Table 3-56 Residential - Toilet Rebate: Summary Table

Final Project Count:	184
Ex Post Gross Energy Savings [kWh]:	5,849
Ex Post Gross Demand Savings [kW]:	0.6
Ex Post Gross Water Savings [CCF]:	715
Total Resource Cost [\$ kWh]:	\$0.89
Net-To-Gross Ratio:	86%
Program Contribution to Portfolio:	< 1%
General EM&V Approach	Desk Review
Survey Sample Size	0

The Water Efficient Toilet Rebate Program encourages customers to replace high-water use toilets to low water use toilets by providing increasing incentives for more efficient toilets. In 1992 the Federal toilet standards went into effect requiring toilets installed in residential new construction to use 1.6 gallons of water per flush or less. Many “older” homes and businesses still have high-water use toilets that use between 3 and 7 gallons per flush (GPF). Recent advancements have allowed toilets to use 1.28 gallons per flush or less while still providing equal or superior performance. This is 20 percent less water than the current 1.6 GPF federal standard.

3.8.1. Gross Impact Evaluation Methods and Results

ADM applied an identical gross impact method to the Toilet Rebate Program as was described in Section 0 for the Toilet Exchange Program. The UES estimates were identical as were the measure offerings.

3.8.2. Net Impact Methods and Results

As this program is implemented by a third party, and is nearly identical to the Toilet Exchange program, the net-to-gross ratio for the rebate program was used from the PY 2014 Evaluation. The Net-To-Gross rate applied to this program, and final net impacts are shown in Table 3-57.

Table 3-57 NTGR and Gross Impacts for Toilet Rebate Program

<i>Free Ridership Estimate</i>	<i>NTG Ratio</i>	<i>Ex Post Gross Annual Energy Savings [kWh]</i>	<i>Ex Post Gross Peak Demand Reductions [kW]</i>	<i>Ex Post Gross Gallons [CCF]</i>
14%	86%	5,849	0.6	712

3.8.3. Evaluation Findings and Program Recommendations

The following represent ADM’s key findings for the CY 2015 evaluation of the Toilet Rebate program:

- **Incentive Levels Contribute to Low TRC Test Results.** Currently the incentive levels for this measure are high relative to “typical” energy efficiency measures (which range between \$.06 to \$0.20 per Gross kWh). A reduction in the incentive levels would improve the cost effectiveness for this program, though such an action would need to be weighed against the potential impacts on customer participation.

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Increase cross-promotion of Toilet Exchange program.** Customers who participate in the Toilet Rebate program should be encouraged to participate in the Toilet Exchange program.
- **Increase cross-promotion of other TDPUD residential programs.** Although many customers received rebates for other appliances, they may be unaware of the full portfolio of residential programs TDPUD offers.

3.9. Residential - Building Efficiency

Table 3-58 Residential - Building Efficiency: Summary Table

Final Project Count:	45
Ex Post Gross Energy Savings [kWh]:	5,310
Ex Post Gross Demand Savings [kW]:	12.5
Ex Post Gross Gas Savings [Therms]:	1,954
Total Resource Cost [\$/kWh]:	\$0.43
Net-To-Gross Ratio:	76%
Program Contribution to Portfolio:	< 1%
General EM&V Approach	Desk Review

EPA estimates that homeowners can typically save up to 10% of total energy costs by air sealing their homes and adding insulation. Additionally, sealing and insulating ducts can save as much as 20% of the energy for heating/cooling. Customers who test and repair their home’s envelope or duct system to save energy received rebates through this program.

3.9.1. Gross Impact Evaluation Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = UES_{kWh} * N$$

$$kW_{Sav} = UES_{kW} * N$$

Where:

- kWh_{Sav} Are the annual energy impacts for the project
- kW_{Sav} Are the peak demand reductions
- UES_{kWh/kW} Is the per unit energy/demand savings estimate for each measure.
- N Is the number of measures implemented

Two separate UES values were determined for this program (one for each measure offered). Based on the information available from each site, the best available source for UES estimates was the CMUA TRM. Table 3-59 summarizes the UES values used for Duct leakage and Table 3-60 provides the same for envelope mitigation.

Table 3-59 UES Values used for Duct Repair Measure

<i>Climate Zone</i>	<i>kWh</i>	<i>KW</i>
CZ16	118	0.278

Table 3-60 UES Values used for Envelope Mitigation Measure

<i>Climate Zone</i>	<i>Sngl Story 15 %</i>	<i>Sngl Story 30 %</i>	<i>2 Story 15 %</i>	<i>2 Story 30 %</i>
CZ16	10.8	20.8	13.6	29.2

3.9.2. Net Impact Methods and Results

The applied NTG ratio is 74% for Duct Repair and 80% for Building Envelope Mitigation, and was derived from the PY 2013 evaluation report for this program. These values were multiplied by gross per-unit kWh to derive program net savings [kWh] and net peak demand reduction [kW]. Program NTGR and associated Net savings values are shown in Table 3-61.

Table 3-61 NTGR and Gross Impacts for Building Efficiency Rebate Program

	<i>Free Ridership Estimate</i>	<i>NTG Ratio</i>	<i>Ex Post Gross Annual Energy Savings [kWh]</i>	<i>Ex Post Gross Peak Demand Reductions [kW]</i>
Duct Repair	26%	74%	3,658	8.6
Building Envelope Mitigation	20%	80%	1,652	3.9

3.9.3. Evaluation Findings and Program Recommendations

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Increase cross-promotion of other TDPUD residential programs.** Although many customers received rebates for other appliances, they may be unaware of the full portfolio of residential programs TDPUD offers.

3.10. Residential - Windows

Table 3-62 Residential - Windows: Summary Table

Final Project Count:	144
Ex Post Gross Energy Savings [kWh]:	230
Ex Post Gross Demand Savings [kW]:	0.93
Ex Post Gross Gas Savings [Therms]:	85
Total Resource Cost [\$/kWh]:	\$0.32
Net-To-Gross Ratio:	100%
Program Contribution to Portfolio:	0%
General EM&V Approach	Desk Review

TDPUD pays \$5 per square foot of window to replace single-pane windows or dual-pane windows over 20 years old with qualifying windows.

3.10.1. Gross Impact Evaluation Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = UES_{kWh} * N$$

$$kW_{Sav} = UES_{kW} * N$$

Where:

- kWh_{Sav} Are the annual energy impacts for the project
- kW_{Sav} Are the peak demand reductions
- UES_{kWh/kW} Is the per unit energy/demand savings estimate for each measure.
- N Is the number of measures implemented

UES estimates were reviewed from various secondary sources including the CMUA TRM, the Pennsylvania TRM, and previous TDPUD evaluation reports. It was evident from literature research that the current claims are of an appropriate magnitude, and possibly even conservative. Given the many uncertainties (discussed in the findings/recommendations) in attempting to apply these numbers to TDPUD, ADM applied the current estimate of 1.6 kWh/Sq. Ft. in the PY 2015 evaluation.

3.10.2. Net Impact Methods and Results

Net impacts were not reviewed directly for this program. The applied NTG ratio is 1.00 and was derived from the PY 2014 evaluation report for this program. This value was multiplied by gross per-unit kWh to derive program net savings [kWh] and net peak

demand reduction [kW]. Program NTGR and associated Net savings values are shown in Table 3-63.

Table 3-63 NTGR and Gross Impacts for Thermally Efficient Windows Rebate Program

<i>Free Ridership Estimate</i>	<i>NTGR Estimate (1-FR)</i>	<i>Ex Post Gross Annual Energy Savings [kWh]</i>	<i>Ex Post Gross Peak Demand Reductions [kW]</i>
0%	100%	230	0.93

3.10.3. Evaluation Findings and Program Recommendations

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Increase cross-promotion of other TDPUD residential programs.** Although many customers received rebates for other appliances, they may be unaware of the full portfolio of residential programs TDPUD offers.

3.11. Residential - Million CFLs

Table 3-64 Million CFLs: Summary Table

Final Project Count:	17,338
Ex Post Gross Energy Savings [kWh]:	375,885
Ex Post Gross Demand Savings [kW]:	25
Total Resource Cost [\$/kWh]:	\$0.05
Net-To-Gross Ratio:	69%
Program Contribution to Portfolio:	27%
General EM&V Approach	Option A
Survey Sample Size	37

The Million CFL program provides free 13 Watt CFL spirals at give-away events to persons who come into the utility offices and request them. The goal is to install one million CFLs over 10 years by providing free CFL 12-packs and other high efficiency lights. This includes handing them out at the Truckee Home & Building Show, Chamber Mixers, and other community events.

3.11.1. Gross Impact Evaluation Methodology and Results

ADM conducted a desk review of the program, using program documentation and tracking data to estimate annual impacts. ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = UES * N$$

$$kW_{Sav} = UES * N$$

Where:

- kWh_{Sav} Are the annual energy impacts for the project
- kW_{Sav} Are the peak demand reductions
- UES Unit Energy Savings estimate
- N Is the number of measures implemented

Program impacts were estimated using the results from the Residential Green Partners CFL program described in Section 3.3. The assumptions are listed in Table 3-65.

Table 3-65 Summary of Savings Estimates: Million CFLs

<i>Parameter</i>	<i>Value</i>
Unit Energy Estimate [kWh/Year]	43.5
Unit Demand Savings Estimate [kW]	.05

CFL inventory levels were reviewed and CFLs given away through other programs were cross-checked against the quantities identified for the Million CFL program. In total, 17,338 CFLs were confirmed to have been given away through this program in CY 2015.

3.11.2. **Sampling Methodology**

For programs with relatively homogenous measures, ADM conducted a simple random sample of participants. Specifically, ADM chose participants with email addresses to conduct an online survey. ADM contacted 375 customers who were participants from the Green Partners, RES/ESP, and Refrigerator Recycling programs.

3.11.3. **Installation Rates**

Respondents were asked questions regarding whether or not they had received any free CFL bulbs at a local community event, how many bulbs they received and installed in their homes, the location of the bulbs in their homes, and whether or not they were installed in a home within Truckee proper. ADM contacted a total 375 participants via online survey from which we completed 102 responses (27.2% response rate). However, only 37 respondents reported they had received bulbs during a community event (36.3% of completed responses). The Evaluators determined the installation rate of the CFL giveaway bulbs to be 83%.

3.11.4. **Net Impact Methods and Results**

ADM applied the Net-To-Gross value derived for the Residential Green Partners program to the Million CFL program given their similarities. The NTG ratio applied was 0.69. Program NTGR and associated Net savings values are shown in Table 3-66.

Table 3-66 NTGR and Gross Impacts for Million CFLs Program

<i>Free Ridership Estimate</i>	<i>NTGR Estimate (1-FR)</i>	<i>Ex Post Gross Annual Energy Savings [kWh]</i>	<i>Ex Post Gross Peak Demand Reductions [kW]</i>
31%	69%	375,885	25

3.11.5. **Evaluation Findings and Program Recommendations**

The evaluation team has the following findings for this program:

- **Reduced savings potential for lighting measures.** Application of EISA standards for gross impact baseline reduced unit energy savings from CFL and LED measures relative to last year.
- **Potential for “leakage” outside of TDPUD territory.** There exists a possibility that bulbs given away at community events could end up outside of TDPUD territory given that 1) not all Truckee residents are PUD customers, and 2) many people from communities outside of Truckee attend community events in Truckee.

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Consider surveying customers at give-away events.** Given the potential for bulbs to leak out of PUD territory we recommend that PUD staff survey customers for their electric utility (or location of primary) residence when handing out bulbs. This data can be used to help future events better target PUD customers specifically.

3.12. Residential - Water Leak Rebate

Table 3-67 Residential - Residential - Water Leak Rebate: Summary Table

Final Project Count:	27
Ex Post Gross Energy Savings [kWh]:	35,096
Ex Post Gross Demand Savings [kW]:	4.0
Ex Post Gross Water Savings [CCF]:	13,018
Total Resource Cost [\$/kWh]:	\$0.03
Net-To-Gross Ratio:	77%
Program Contribution to Portfolio:	3%
General EM&V Approach	Desk Review

The Truckee Donner PUD began installing meters in the summer of 2009 as required by California State Law. One feature of the water meters is the ability to remotely detect water leaks on the customer-side of the water meter. We have found that over 10% of our customers have leaks on water or irrigation piping and/or fixtures. Water leaks can be very costly if not repaired. The Water Leak Repair Rebate is intended to help customers offset the cost of locating and repairing leaks that require the services of a licensed professional by offering a rebate of up to \$100.

3.12.1. Gross Impact Evaluation Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{sav} = UES * N$$

$$kW_{sav} = UES * N$$

Where:

- kWh_{Sav} Are the annual energy impacts for the project
- kW_{Sav} Are the peak demand reductions
- UES Unit Energy Savings estimate
- N Is the number of measures implemented

The UES estimates were developed by performing regression analysis on billing data from program participants (IPMVP Option C). The regression equation took the following form:

$$Q_{Day} = \beta_1 * SITE * Seas + \beta_2 * SITE * LK + \beta_3 * SITE * TEMP$$

Where:

- Q_{Day} Daily Water Consumption [Gallons]
- SITE Variable indicating difference in usage from one site to the next
- Seas Used to capture differences in usage correlated with seasonality
- LK Dummy variable representing the presence of a leak
- TEMP Average ambient temperature for time period

Figure 3-9 illustrates the water savings identified for each site through this regression. What remains unknown is how long these leaks would have persisted in the absence of the program as no non-participant data was reviewed. As such, the regressed average impact of .790 MG (3,686 kWh) per site is expected to be high. When several outlier sites are removed the average savings drops to 1,385 kWh per year which is slightly less than what was verified in the CY 2013 evaluation.

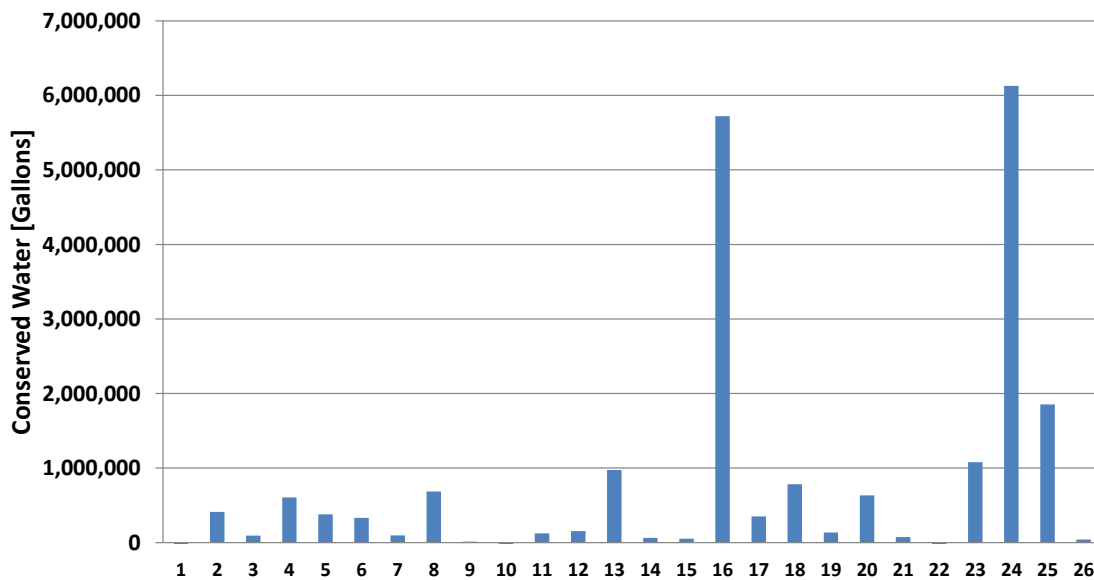


Figure 3-9 Estimated Annual Water Impacts [Gal] per Regression Analysis

Since the current Ex Ante estimate is based on a previous billing analysis (performed during the 2011 EM&V cycle), and since the current analysis would yield 1,688 kWh/Site if the lowest outlier is included in the mean per-site estimate, ADM concluded that an estimate of 361,628 gallons per year (1,688.11 kWh) per site is reasonable.

3.12.2. Net Impact Methods and Results

Net impacts were not reviewed directly for this program. The applied NTG ratio is 0.77 and was derived from the PY 2013 evaluation report for this program. Program NTGR and associated Net savings values are shown in Table 3-68.

Table 3-68 NTGR and Gross Impacts for Water Leak Rebate Program

<i>Free Ridership Estimate</i>	<i>NTGR Estimate (1-FR)</i>	<i>Ex Post Gross Annual Energy Savings [kWh]</i>	<i>Ex Post Gross Peak Demand Reductions [kW]</i>	<i>Ex Post Gross Water Savings [CCF]</i>
33%	77%	35,096	4.0	13,018

3.12.3. Evaluation Findings and Program Recommendations

The following represent key findings for the PY 2015 evaluation of the Water Leak Rebate program:

- **High Savings Potential.** Based on the rudimentary billing analysis performed in this evaluation the program appears to have a significant water savings potential, and the highest energy savings potential of the water conservation programs offered by TDPUD.

3.14. Residential – Misc. Water Measures

Table 3-69 Residential – Misc. Water Measures: Summary Table

Project Count:	3,525
Ex Post Gross Energy Savings [kWh]:	129,061
Ex Post Gross Demand Savings [kW]:	15
Ex Post Gross Water Savings [CCF]:	3,587
Total Resource Cost [\$/kWh]:	\$0.06
Net-To-Gross Ratio:	77%
Program Contribution to Portfolio:	9%
General EM&V Approach	Desk Review

Encourages customers to replace high water use fixtures with water efficient fixtures by distributing, in person and for free, various measures. Water efficient measures are distributed to customers who visit the TDPUD Conservation Department or local events.

3.14.1. Gross Impact Evaluation Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = UES_{kWh} * N$$

$$kW_{Sav} = UES_{kW} * N$$

Where:

kWh_{Sav} Are the annual energy impacts for the project

kW_{Sav} Are the peak demand reductions

$UES_{kWh/kW}$ Is the per unit energy/demand savings estimate for each measure.

N Is the number of measures implemented

UES estimates were derived using the energy intensity of water derived for TDPUD customers through a study performed in 2015. Additionally, various secondary sources were reviewed for appropriate water conservation estimates.

3.14.2. Net Impact Methods and Results

Net impacts were not reviewed directly for this program. The applied NTG ratio is 0.77 and was derived from the PY 2013 evaluation report for this program. Program NTGR and associated Net savings values are shown in Table 3-70.

Table 3-70 NTGR and Gross Impacts for Misc. Water Measures Program

<i>Free Ridership Estimate</i>	<i>NTGR Estimate (1-FR)</i>	<i>Ex Post Gross Annual Energy Savings [kWh]</i>	<i>Ex Post Gross Peak Demand Reductions [kW]</i>	<i>Ex Post Gross Water Savings [CCF]</i>
33%	77%	129,061	15	3,587

3.14.3. Evaluation Findings and Program Recommendations

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Increase cross-promotion of other TDPUD residential programs.** Although many customers received rebates for other appliances, they may be unaware of the full portfolio of residential programs TDPUD offers.

3.15. Residential – LED Holiday Light Exchange

Table 3-71 Residential – LED Holiday Light Exchange: Summary Table

Project Count:	1,272
Ex Post Gross Energy Savings [kWh]:	11,481
Ex Post Gross Demand Savings [kW]:	0
Total Resource Cost [\$/kWh]:	\$0.41
Net-To-Gross Ratio:	91%
Program Contribution to Portfolio:	1%
General EM&V Approach	Desk Review

The Holiday Swap program provides customers with energy efficient LED holiday lights. Customers bring in their own, inefficient, lights and TDPUD staff exchange them for more efficient LED variants. Four different types of LED holiday lights were available through the program which included C6 LED White, C6 LED Multi-Color, 5MM Mini Warm White, and 5MM Mini Multi-Color strands.

3.15.1. Gross Impact Evaluation Methods and Results

ADM conducted a desk review of the program, using program documentation and tracking data to estimate annual impacts. ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = UES * N$$

Where:

- kWh_{Sav} Are the annual energy impacts for the project
- UES Unit Energy Savings estimate
- N Is the number of measures implemented

The program UES estimate was derived using an engineering equation (IPMVP Option A) for each of the 3 types of non-LED holiday lights replaced through this program. The equation for each light took the following form:

$$UES = N_{Bulbs} * \Delta P_{Bulb} * Hrs$$

Where:

- UES_{Bulb} Energy Savings Estimate
- N_{Bulbs} Is the number of bulbs per strand
- ΔP_{Bulb} Is the delta power (kW) between the non-LED and LED bulbs

Hrs Annual operating hours per strand

The UES determined for this measure was 9.0 kWh/Year-strand. Residential strands were assumed to operate 10 hours per day for 31 days a year and business strands were assumed to operate 8 hours per day for 31 days a year.

3.15.2. Net Impact Methods and Results

Net impacts were not reviewed directly for this program. The applied NTG ratio is 0.91 and was derived from the PY 2013 evaluation report for this program. Program NTGR and associated Net savings values are shown in Table 3-72.

Table 3-72 NTGR and Gross Impacts for LED Holiday Light Exchange Program

<i>Free Ridership Estimate</i>	<i>NTGR Estimate (1-FR)</i>	<i>Ex Post Gross Annual Energy Savings [kWh]</i>	<i>Ex Post Gross Peak Demand Reductions [kW]</i>
9%	91%	11,481	0

3.15.3. Evaluation Findings and Program Recommendations

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Increase cross-promotion of other TDPUD residential programs.** Although many customers received rebates for other appliances, they may be unaware of the full portfolio of residential programs TDPUD offers.

3.16. Residential – Green Schools Program

Table 3-73 Residential – Green Schools Program: Summary Table

Project Count:	1,758
Ex Post Gross Energy Savings [kWh]:	35,242
Ex Post Gross Demand Savings [kW]:	2.3
Total Resource Cost [\$/kWh]:	\$0.15
Net-To-Gross Ratio:	69%
Program Contribution to Portfolio:	1%
General EM&V Approach	Desk Review

The Green Schools program promotes energy and water conservation through an innovative series of programs designed to both educate students and deliver, for free, energy and water savings measures. The program is run in collaboration with the Sierra Watershed Education Program (SWEP) Green Teams, the Envirolution Club Trashion Show, and Truckee Tahoe Unified School District. The Green Teams are sustainability clubs at local elementary schools that utilize educational projects to empower students and teacher to be good global citizens, working to ensure adequate resources for a clean and healthy environment. SWEP educators, along with high school mentors, facilitate weekly sustainability club meetings exploring service learning projects including energy and water conservation.

3.16.1. Gross Impact Evaluation Methods and Results

ADM conducted a desk review of the program, using program documentation and tracking data to estimate annual impacts. ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = UES * N$$

$$kW_{Sav} = UES * N$$

Where:

- kWh_{Sav} Are the annual energy impacts for the project
- kW_{Sav} Are the peak demand reductions
- UES Unit Energy/Demand Savings estimate
- N Is the number of measures implemented

Program impacts were estimated using the results and assumptions from the Residential Green Partners CFL program described in Section 3.3. The assumptions are listed in Table 3-74.

Table 3-74 Summary of Savings Estimates: Green Schools Program

<i>Parameter</i>	<i>UES_{kWh} [kWh/Year]</i>	<i>UES_{kW} [kW/Year]</i>
LED A19	25	0.0017

In total, 1,758 LEDs were given away through this program in CY 2015.

3.16.2. Net Impact Methods and Results

ADM applied the Net-To-Gross value derived for the Residential Green Partners Program to the Green Schools program given their similarities. The NTG ratio applied was 0.69. Program NTGR and associated Net savings values are shown in Table 3-75.

Table 3-75 NTGR and Gross Impacts for Green Schools Program

<i>Free Ridership Estimate</i>	<i>NTGR Estimate (1-FR)</i>	<i>Ex Post Gross Annual Energy Savings [kWh]</i>	<i>Ex Post Gross Peak Demand Reductions [kW]</i>
31%	69%	35,242	2.3

3.16.3. Evaluation Findings and Program Recommendations

The evaluation team has the following findings for this program:

- **Reduced savings potential for lighting measures.** Application of EISA standards for gross impact baseline reduced unit energy savings from CFL and LED measures relative to last year.

3.17. Residential – High Efficiency Washer Water Rebate

Table 3-76 Residential - High Efficiency Washer Water: Summary Table

Final Project Count:	93
Ex Post Gross Energy Savings [kWh]:	1,258
Ex Post Gross Demand Savings [kW]:	0.14
Ex Post Gross Water Savings [CCF]:	153
Total Resource Cost [\$/kWh]:	\$1.69
Net-To-Gross Ratio:	68%
Program Contribution to Portfolio:	< 1%
General EM&V Approach	Desk Review

This program provides TDPUD customers incentives for purchasing water efficient clothes washing machines as identified by Energy Star and the Consortium of Energy Efficiency (CEE). Energy Star and CEE Tier 1 identify appliances that use less energy than the federal standard. CEE Tiers 2 & 3 identify super-efficient appliances that use significantly less energy than the federal standard and identify the most efficient of the Energy Star spectrum.

3.17.1. Gross Impact Evaluation Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = UES * N$$

$$kW_{Sav} = \frac{kWh_{Sav}}{8760}$$

Where:

- kWh_{Sav} Are the annual energy impacts for the project
- kW_{Sav} Are the peak demand reductions
- UES Is the per unit energy savings estimate for each measure.
- N Is the number of measures implemented

UES estimates were derived based on the CEE Tier of the installed unit. ADM used engineering calculations to derive the unit energy savings estimates along with secondary literature research to establish appropriate assumptions. The following formula was used to estimate the UES;

$$kWh_{Washer} = V_{Load} * \Delta WF * Cycles/Year * \gamma$$

Where:

- kWh_{Washer} Are the annual energy impacts for the retrofit
- V_{Load} The volume of water consumed in each load of laundry
- ΔWF The difference in Water Factor rating between the base and efficient unit
- Cycles/Year The number of washing loads run in a year.
- γ Is the embedded energy content of water used ¹³

Final values for each of the three toilet volume combinations offered through the program are listed in Table 3-77.

Table 3-77 List of UES estimates for Each Clothes Washer Represented in the Program: Clothes Washer Program

<i>Measure</i>	<i>Gross Energy Impacts [kWh/Washer]</i>	<i>Gross Water Impacts [Gal/Washer]</i>
Efficient Washer	5.9	1,232

3.17.2. Net Impact Methods and Results

Net impacts were not reviewed directly for this program. The applied NTG ratio is 0.68 and was derived from the PY 2013 evaluation report for this program. Program NTGR and associated Net savings values are shown in Table 3-78.

Table 3-78 NTGR and Gross Impacts for High Efficiency Clothes Washer Program

<i>Free Ridership Estimate</i>	<i>NTGR Estimate (1-FR)</i>	<i>Ex Post Gross Annual Energy Savings [kWh]</i>	<i>Ex Post Gross Peak Demand Reductions [kW]</i>	<i>Ex Post Gross Water Savings [CCF]</i>
32%	68%	1,258	0.14	153

3.17.3. Evaluation Findings and Program Recommendations

The evaluation team has the following recommendations to improve program performance in future program cycles:

¹³ The embedded energy content of water was assumed to be .0047 kWh/Gal based on two years data on TDPUD's water distribution. Note that this is a conservative estimate as it does not include the cost of water conveyance through Truckee Sanitary District or the cost of processing at the Tahoe Truckee Sanitation Agency waste-water treatment plant. A study is currently on-going to establish final values for these additional components.

- **Increase cross-promotion of other TDPUD residential programs.** Although many customers received rebates for other appliances, they may be unaware of the full portfolio of residential programs TDPUD offers.

3.18. Residential - Electric Water Heater

Table 3-79 Residential - Electric Water Heater: Summary Table

Final Project Count:	5
Ex Post Gross Energy Savings [kWh]:	617
Ex Post Gross Demand Savings [kW]:	0.1
Total Resource Cost [\$/kWh]:	\$0.12
Net-To-Gross Ratio:	79%
Program Contribution to Portfolio:	< 1%
General EM&V Approach	Desk Review

TDPUD pays \$2/gallon for new, qualifying electric water heaters. Maximum rebate \$150. Qualifying water heater must have the following Energy Factor:

<i>Water Heater Capacity</i>	<i>Energy Factor (EF)</i>
60 gallons or greater	.91 (91%) or Higher
59 gallons or less	.93 (93%) or Higher

3.18.1. Gross Impact Evaluation Methods and Results

ADM conducted a desk review of the program, using program documentation and tracking data to estimate annual impacts. ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = UES * N$$

$$kW_{Sav} = UES * N$$

Where:

- kWh_{Sav} Are the annual energy impacts for the project
- kW_{Sav} Are the peak demand reductions
- UES Unit Energy/Demand Savings estimate
- N Is the number of measures implemented

UES estimates were derived from the most recent information at the Regional Technical Forum on this measure. The RTF provides the following assumptions for energy impacts for this measure:

<i>Size Category</i>	<i>Gallons</i>	<i>RTF Workbook Savings</i>		
		<i>Savings (Btu/hour)</i>	<i>Savings (kWh/year)</i>	<i>Savings (kWh/year/Gallon)</i>
'>= 25 gallons, <35 gallons	30	28.51	73.25	2.44
'>= 35 gallons, <45 gallons	40	53.03	136.25	3.41
'>= 45 gallons, <55 gallons	50	72.11	185.28	3.71
'>= 55 gallons, <75 gallons	60	91.77	235.79	3.93
'>= 75 gallons, <100 gallons	70	62.26	159.96	2.29
'>= 100 gallons, <120 gallons	80	57.69	148.22	1.85
			Average:	2.94

3.18.2. Net Impact Methods and Results

Net impacts were not reviewed directly for this program. The applied NTG ratio is 0.79 and was derived from the PY 2013 evaluation report for this program. Program NTGR and associated Net savings values are shown in Table 3-80Table 3-78.

Table 3-80 NTGR and Gross Impacts for Electric Water Heater Rebate Program

<i>Free Ridership Estimate</i>	<i>NTG Ratio</i>	<i>Ex Post Gross Annual Energy Savings [kWh]</i>	<i>Ex Post Gross Peak Demand Reductions [kW]</i>
21%	79%	617	0.1

3.18.3. Evaluation Findings and Program Recommendations

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Increase cross-promotion of other TDPUD residential programs.** Although many customers received rebates for other appliances, they may be unaware of the full portfolio of residential programs TDPUD offers.

4. EM&V Approach: Commercial Programs

In this chapter we discuss the Evaluation results (including findings and recommendations) for each evaluated commercial program. Programs are listed in order of contribution to the overall portfolio.

4.1. Commercial - Green Partners LED/CFL

Table 4-1 Commercial - Green Partners LED/CFL: Summary Table

Project Count:	28
Ex Post Gross Energy Savings [kWh]:	124,801
Ex Post Gross Demand Savings [kW]:	11.5
Total Resource Cost [\$/kWh]:	\$0.08
Net-To-Gross Ratio:	47%
Program Contribution to Portfolio:	10%
General EM&V Approach	Option A
Sample Size	13

The Commercial – Green Partners LED/CFL program provides efficient Light Emitting Diode (LED) and Compact Florescent bulbs free of charge to commercial customers. Bulbs are intended to replace existing incandescent and halogen bulbs. TDPUD conservation specialists visit businesses to evaluate lighting needs and provide solutions.

4.1.1. Sample Design

The evaluation used a stratified random sample design to survey program participants regarding installation rates and free-ridership. Four strata were developed based on ex ante estimates for program participants with the following statistics:

Table 4-2 Population & Sample Summary: Commercial Green Partners LED/CFL Program

<i>Strata</i>	<i>Ex Ante Savings [kWh]</i>	<i>Population Size</i>	<i>Stratum Cv</i>	<i>Sample Size</i>
1	12,356	12	0.493	3
2	52,989	12	0.377	6
3	62,317	4	0.653	4

The total sample size for this program was 13 sites. Results from this sample design are representative of the population within a ±8% precision at the 90% confidence level.

4.1.2. Gross Impact Methods and Results

ADM leveraged a *Deemed Savings* approach to this program in which we applied the following formula to estimate gross impacts:

$$kWh_{Sav} = (kW_{Base} - kW_{CFL}) * Hrs * HCIF * ISR$$

$$kW_{Sav} = (kW_{Base} - kW_{CFL}) * CDF * HCIF * ISR$$

where:

kWh _{Sav}	Are the annual energy impacts for the project
kW _{Sav}	Are the peak demand reductions
kW _{Base}	Is the connected load of the baseline light bulb ¹⁴
kW _{CFL}	Is the connected load of the installed light bulb ¹⁵
Hrs	Are the annual hours of operation ¹⁶
HCIF	Heating/Cooling Interactive Factor ¹⁷
CDF	Is the Coincident Demand Factor
ISR	Is the <i>In-Service Rate</i>

The *In-Service Rate* was derived using customer surveys to identify how many of the bulbs received had actually been installed. Additional questions were asked to identify the locations in which the bulbs were installed. Table 4-13 provides a breakdown of the installation rates observed by strata and overall.

Table 4-3 Summary of Installation Rates for Commercial Green Partners LED Program

<i>Strata</i>	<i>ISR</i>
1	91%
2	100%
3	100%
Overall	98%

The population of projects was sufficiently small that DEER building types were ascribed to each via internet research (e.g. using the address and business name). DEER hours of use, Coincident Demand Factor, and interactive factors were then applied based on the project's building type. The Ex Post gross impacts are provided in Table 4-14.

¹⁴ Assessed using an assumed baseline wattage based on the wattage/type of the installed bulb and further informed through surveys

¹⁵ Based on the records kept in the tracking system and further informed by the surveys

¹⁶ Per DEER 2013 for appropriate building type

¹⁷ Per DEER 2013 for appropriate building type

Table 4-4 Gross Impacts for Commercial Green Partners LED/CFL Program

<i>Strata</i>	<i>Gross Ex Post Annual Energy Impacts [kWh]</i>	<i>Gross Ex Post Peak Demand Reductions [kW]</i>
1	15,057	1.4
2	43,227	4.0
3	66,517	6.1
Overall	124,801	11.5

4.1.3. Net Impact Methods and Results

ADM employed the Net-To-Gross method outlined for programs evaluated with a Deemed Savings approach (see Section 2.2.1 for details). The resulting estimate for program free-ridership (FR) and the subsequent net-to-gross ratio (NTG) is provided for each strata in Table 4-15. Table 4-15 also presents the factors calculated for each strata used to estimate program free-ridership.

Table 4-5 Summary of Program Free-Ridership Estimates: Commercial Green Partners LED Program

<i>Free-Ridership Factors</i>					<i>FR</i>	<i>NTG</i>
<i>Strata</i>	<i>Behavior w/o Giveaway</i>	<i>Tendency To Buy Incandescent</i>	<i>Behavior incorporating incandescent tendency</i>	<i>Prior Experience</i>		
1	0.9	0.00	0.9	0.8	0.86	0.14
2	0.5	0.25	0.4	0.75	0.58	0.42
3	0.1	0.25	0.2	0.9	0.56	0.44
Overall	-	-	-	-	0.53	0.47

4.1.4. Customer Surveys

The sampled customers received telephone surveys or on-site verification regarding their participation in the program. While this survey was focused on collecting data used to determine the net-to-gross ratio and installation rates, additional data was collected to qualify customer:

- Awareness of the program,
- Decision-making processes, and
- Overall satisfaction with the program.

Several avenues through which participants indicated awareness of the program were identified, though the majority of respondents heard of the program through:

- Direct communication with utility staff (55%),
- Participation in other programs (9%)¹⁸,
- Program marketing materials (9%)¹⁹,
- Word of mouth (9%); or
- Truckee Thursday events (27%).

The responses to questions pertaining to program satisfaction are summarized in Table 4-16.

Table 4-6 Customer Satisfaction Responses: Commercial Green Partners LED/CFL Program

<i>Question</i>	<i>Very Satisfied</i>	<i>Satisfied</i>	<i>Neutral</i>	<i>Dissatisfied</i>	<i>Very Dissatisfied</i>
Quality of the LEDs	70%	30%	0%	0%	0%
TDPUD staff	80%	20%	0%	0%	0%
Overall experience	80%	20%	0%	0%	0%

Overall, respondents demonstrated high satisfaction with the program. No responses indicated dissatisfaction within the categories surveyed. Respondents were also asked if they had any comments or suggestions regarding the program. All of the comments received indicated high customer satisfaction with the program and its staff.

4.1.5. Evaluation Findings and Results

The following represent ADM’s key findings for the evaluation of the 2015 Commercial Green Partners LED/CFL program:

- **Program tracking documentation was very good.** Program staff maintained accurate and detailed records of bulb counts, model numbers, wattages, etc. for each project in the program. While a couple of clerical errors were identified in our review of the documentation compared to on-site findings the vast majority of documentation was found to be accurate.
- **High Levels of Customer Satisfaction.** The evaluation found that customers were generally very satisfied with the program and in their interactions with

¹⁸ Including giveaway events

¹⁹ Primarily bill inserts

program staff. No negative responses were indicated through customer surveys regarding either the program's administration or the equipment.

- **Increase in Free-Ridership.** This year free-ridership rates increased for the Commercial Green Partner's program. A number of participants Specifically indicated that they would have purchased LED bulbs even without the PUD's program. It may become important in proceeding program cycles to specifically target customers with a lower likelihood of free-ridership.

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Target local business owners during community outreach events.** A number of surveyed participants responded that they found out about this program directly from PUD staff, many of which noted Truckee Thursday events. These events represent a good marketing opportunity for PUD programs.

4.2. Commercial - Custom

Table 4-7 Commercial - Custom: Summary Table

Project Count:	3
Ex Post Gross Energy Savings [kWh]:	42,518
Ex Post Gross Demand Savings [kW]:	4.9
Total Resource Cost [\$/kWh]:	\$0.08
Net-To-Gross Ratio:	64%
Program Contribution to Portfolio:	3%
General EM&V Approach	Site-Specific
Sample Size	3

The Commercial – Custom program offers incentives for non-standard energy efficiency projects implemented by businesses in TDPUD’s service territory.

4.2.1. Sample Design

The evaluation identified a census of program participants for site inspection. While on-site, evaluation staff collected data regarding measure installation, and surveyed site staff regarding program participation and their decision making processes. No sampling was done (e.g. we evaluated a census of projects) only two projects participated:

Table 4-8 Population Summary: Commercial Custom Program

<i>Site</i>	<i>Ex Ante Energy Savings [kWh]</i>	<i>Ex Ante Demand Savings [kW]</i>	<i>Population Mean [kWh]</i>	<i>Population Cv</i>
TDCUSTOM15-508522	3,428	0	18,860	0.97
TDCUSTOM15-507522	14,061	0		
TDCUSTOM15-508411	39,090	0		

The number of evaluated sites for this program was 3 sites which represent a census of the population.

4.2.2. Gross Impact Methods and Results

ADM leveraged a *Site-Specific* savings approach to this program in which we identified the most appropriate IPMVP option for each sampled site. Table 4-19 summarizes the IPMVP Option and savings identified for each site evaluated.

Table 4-9 Summary of Results by Project (Gross Impacts): Commercial Custom

Project #	IPMVP Option	Gross Ex Post Energy Impacts [kWh]	Gross Ex Post Peak Reduction [kW]
TDCUSTOM15-508522	Option A	3,428	0
TDCUSTOM15-507522	Option C	0	0
TDCUSTOM15-508411	Option A	39,090	4

4.2.3. Net Impact Methods and Results

ADM employed the Net-To-Gross method outlined for programs evaluated with a Site-Specific approach (see Section 2.1.1.2 for details). The resulting estimate for program free-ridership (FR) and the subsequent net-to-gross ratio (NTG) is provided for each project in Table 4-4. Table 4-4 also presents the factors calculated for each project used to estimate program free-ridership.

Table 4-10. Summary of Program Free-Ridership Estimates: Commercial Custom

Project	Had Plans and Intentions to Install Measure without Program? (Definition 1)	Had Plans and Intentions to Install Measure without Program? (Definition 2)	Program had influence on Decision to Install Measure?	Had Previous Experience with Measure?	FR	NTG
1	Y	Y	Y	N	0	1
2	N	N	N	N	0.33	0.67
3	N	Y	Y	N	0.67	0.33
Overall	-	-	-	-	0	0.64

4.2.4. Evaluation Findings and Results

The following represent ADM’s key findings for the CY 2015 evaluation of the Commercial Green Partners LED program:

- **Ex Post Verified Impacts were higher than Ex Ante Estimates.** The final Ex Post verified impacts for this program were found to be greater than the Ex Ante estimates with a realization rate of 174%. Much of this can be attributed to a conservative effort by TDPUD to estimate the impacts for project TDCUSTOM-505660 given its behavioral nature
- **Low Program Participation.** Only three customers participated in the custom program in CY2015. While some of this can be attributed to current socio-economic issues, it may be that the “standard” set of energy efficiency measures

are reaching a state of saturation in Truckee, requiring deeper and more creative retrofits.

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Consider adding a Commercial Audit Component to Proactively Identify Custom Projects.** Much of TDPUD business customers can be classified as small commercial or industrial. These particular customer types can benefit significantly from energy audits of their facilities. Such audits would enable TDPUD to actively identify custom measures (in addition to smaller projects which fit into other existing programs).
- **Consider promoting Prop 39 funds to educational facilities in Truckee.** Proposition 39 provides funding for energy efficiency improvements in educational facilities. Helping local educational facilities take advantage of these funds could improve program participation.

4.3. Commercial - Lighting

Table 4-11 Commercial - Lighting: Summary Table

Project Count:	15
Ex Post Gross Energy Savings [kWh]:	146,016
Ex Post Gross Demand Savings [kW]:	21.6
Total Resource Cost [\$/kWh]:	\$0.07
Net-To-Gross Ratio:	93%
Program Contribution to Portfolio:	10%
General EM&V Approach	Site-Specific
Sample Size	9

The Commercial – Lighting program provides incentives for businesses to replace old linear fluorescent fixtures with reduced wattage T-8 fluorescent or LED fixtures. Other retrofits may qualify for a rebate equivalent to projected first year energy savings.

4.3.1. Sample Design

The evaluation used a stratified random sample design to identify program participants for site inspection. While on-site, evaluation staff collected data regarding measure installation, and surveyed site staff regarding program participation and their decision making processes. Three strata were developed based on ex ante estimates for program participants with the following statistics:

Table 4-12 Population & Sample Summary: Commercial Lighting

<i>Strata</i>	<i>Ex Ante Savings [kWh]</i>	<i>Population Size</i>	<i>Stratum Cv</i>	<i>Sample Size</i>
1	24,600.00	7	0.637	3
2	71,228.50	6	0.236	4
3	61,087.00	2	0.021	2

The total sample size for this program was 9 sites. Results from this sample design are representative of the population within a $\pm 9\%$ precision at the 90% confidence level.

4.3.2. Gross Impact Methods and Results

ADM leveraged a *Site-Specific* savings approach to this program in which we identified the most appropriate IPMVP option for each sampled site. Table 4-23 summarizes the IPMVP Option and savings identified for each site evaluated.

Table 4-13 Summary of Results by Sampled Project (Gross Impacts): Refrigeration

<i>Project #</i>	<i>IPMVP Option</i>	<i>Gross Ex Post Energy Impacts [kWh]</i>	<i>Gross Ex Post Peak Reduction [kW]</i>
COMLIGHT15-507517	Option A	838	0.3
COMLIGHT15-508052	Option A	4,815	0
COMLIGHT15-508051	Option A	6,336	0
COMLIGHT15-507932	Option A	8,931	3.6
COMLIGHT15-508204	Option A	8,039	2
COMLIGHT15-508516	Option A	10,711	2.8
COMLIGHT15-508746	Option A	14,183	0
COMLIGHT15-507733	Option A	30,067	0
COMLIGHT15-507516	Option A	27,942	7.2

4.3.3. Net Impact Methods and Results

ADM employed the Net-To-Gross method outlined for programs evaluated with a Site-Specific approach (see Section 2.1.1.2 for details). The resulting estimate for program free-ridership (FR) and the subsequent net-to-gross ratio (NTG) is provided for each project in Table 4-24. Table 4-24 also presents the factors calculated for each project used to estimate program free-ridership.

Table 4-14 Summary of Program Free-Ridership Estimates: Commercial Lighting

Project	<i>Had Plans and Intentions to Install Measure without Program? (Definition 1)</i>	<i>Had Plans and Intentions to Install Measure without Program? (Definition 2)</i>	<i>Program had influence on Decision to Install Measure?</i>	<i>Had Previous Experience with Measure?</i>	FR	NTG
1	N	N	Y	N	0	1
2	N	N	N	Y	0.33	0.67
3	N	N	Y	N	0	1
4	N	N	Y	N	0	1
5	N	N	Y	Y	0	1
6	N	N	N	N	0	1
7	N	N	Y	N	0	1
8	N	N	Y	N	0	1
9	N	N	N	N	0	1
Overall	-	-	-	-	0.07	0.93

4.3.4. Evaluation Findings and Results

The following represent ADM’s key findings for the CY 2015 evaluation of the Commercial Lighting program:

- **Program tracking documentation was very good.** Program staff maintained accurate and detailed records of fixture model numbers, quantities, wattages, etc. for each project in the program. Only minor revisions were made to the assumed HOU and HCIF values used to derive energy savings estimates. One project also required a small adjustment to the fixture wattages.
- **High Levels of Customer Satisfaction.** The evaluation found that customers were generally very satisfied with the program and in their interactions with program staff. No negative responses were indicated through customer surveys regarding either the program’s administration or the equipment.

The evaluation team has the following recommendations to improve program performance in future program cycles:

- **Consider Promoting Refrigerated Case Lighting.** Refrigerated case-lighting is an effective and cost effective measure for many businesses – not just chain grocery stores. ADM recommends that this measure be promoted by TDPUD, particularly since the Refrigeration program is discontinued.

5. Appendix A: Customer Survey for Res Green Partners Program

Hello, my name is _____ and I'm calling from ADM Associates on behalf of TDPUD. We are conducting a survey regarding household lighting. We are contacting customers that received CFLs/LEDs through the Residential Green Partners program. The survey should only take about 10-15 minutes and your answers will be completely anonymous. Am I speaking to the correct person about this?

Q1. We have it in our records that you received ____ number of bulbs. Is this correct?
[MAX BULBS = 24]

- Yes 01
- No 02 [SKIP TO Q1A]
- Don't know 98 [SKIP TO Q2]

Q1a. How many bulbs did you receive?

- #_____ [RECORD NUMBER, 0 – 24.]
- Don't recall 98
- Refused 99

Q2. How many of those CFLs would you estimate you installed?

- #_____ [RECORD NUMBER. IF RESPONDENT SAYS "100%" or "ALL", THEN SKIP TO Q4]
- Don't recall 98
- Refused 99

Q3. Are there any CFL bulbs you received that you have not installed or are saving for a later date?

- Yes, have some left 01 [GO TO Q3A]
- None 02 [SKIP TO Q4]
- Don't know 98 [SKIP TO Q4]
- Refused 99 [SKIP TO Q4]

Q3a. How many of those CFLs you received did you save to install at a later date? [If respond is unsure, say "Your best estimate is okay."]

- _____ [RECORD NUMBER, 0 – 24]
- Don't recall 98
- Refused 99

Q4. Where in your home did you install the bulbs? (Don't read.)

If customer says, "EVERYWHERE", please ask them to clarify/be specific.

AFTER CUSTOMER INDICATES ROOMS, PROMPT ON EACH ROOM: "How many did you install in (room indicated)?"

	Room	# Bulbs
A	Living room	
B	Kitchen	
C	Family Room / Den	
D	Dining Room	
E	Entry/Hallway	
F	Bedroom	
G	Bathroom	
H	Garage	
I	Outdoors	
J	Closet	
K	Office	
L	Other	

Q5. What type of bulbs did the new CFL bulbs replace? (IF NECESSARY: Did they replace incandescent bulbs? Other CFLs? LEDs?)

- Replaced incandescent lighting (ask Q5a) 01
- Replaced CFLs 02
- Replaced LEDs 03
- Don't Know (Don't Read) 98
- Refused 99

Q5a. (IF THEY REPLACED INCANDESCENT BULBS): Were the incandescent bulbs still operating when you removed them or were they burnt out?

- Still operating 01
- Burnt out 02
- Don't know 98

Q6. How did you become aware of TDPUD's Green Partners Program? [MARK ALL RESPONSES] (Don't read)

- | | |
|--|----|
| <input type="checkbox"/> Bill insert | 01 |
| <input type="checkbox"/> Newspaper ad | 02 |
| <input type="checkbox"/> Television/radio ad | 03 |
| <input type="checkbox"/> Friend/relative/word-of-mouth | 04 |
| <input type="checkbox"/> Flyer | 05 |
| <input type="checkbox"/> At a giveaway event | 06 |
| <input type="checkbox"/> While paying my utility bill | 07 |
| <input type="checkbox"/> TDPUD website | 08 |
| <input type="checkbox"/> Other (Specify): _____ | 09 |
| <input type="checkbox"/> Don't Know | 98 |

Q7. Prior to learning of the program, approximately how many CFL bulbs did you have in your home? [If respond is unsure, say "Your best estimate is okay."]

- | | |
|---------------------------------------|-------------------------|
| <input type="checkbox"/> # _____ | [RECORD NUMBER, 0 – 97] |
| <input type="checkbox"/> Don't recall | 98 |
| <input type="checkbox"/> Refused | 99 |

Q8. If TDPUD had not given out the CFLs, how likely is it that you would have purchased CFLs anyway?

- | | |
|--|----|
| <input type="checkbox"/> Definitely would have purchased | 01 |
| <input type="checkbox"/> Probably would have purchased | 02 |
| <input type="checkbox"/> Probably would not have purchased | 03 |
| <input type="checkbox"/> Definitely would not have purchased | 04 |

Q9. Have you purchased any incandescent light bulbs in the past year?

- | | |
|--|----|
| <input type="checkbox"/> Yes (ask Q9a, Q9b, and Q9c) | 01 |
| <input type="checkbox"/> No | 02 |
| <input type="checkbox"/> Don't Know (Don't Read) | 98 |

Q9a. Why did you purchase incandescent bulbs? [RECORD VERBATIM]

Q9b. Have you installed any of the incandescent light bulbs?

- | | |
|--|----|
| <input type="checkbox"/> Yes (ask Q9c) | 01 |
| <input type="checkbox"/> No (skip to Q10) | 02 |
| <input type="checkbox"/> Don't Know (Don't Read) | 98 |

Q9c. How many of the incandescent light bulbs were installed?

- # _____ [RECORD NUMBER, 0 – 97]
- Don't recall 98
- Refused 99

Q10. After receiving the CFL bulbs from the program, have you since purchased more CFLs or LEDs?

- Yes (ask Q10a, Q10b, Q10c, and Q10d) 01
- No (skip to Q11) 02
- Don't Know (Don't Read) 98

Q10a. If Yes: How many?

CFLs: # _____
LEDs: # _____

Q10b. Did you receive a rebate for any of the purchased bulbs?

- Yes 01
- No 02
- Don't Know (Don't Read) 98

Q10c. Have you installed any of the purchased CFLs or LEDs in your home?

- Yes 01
- No (skip to Q11) 02
- Don't Know (Don't Read) 98

Q10d. How many of the CFLs or LEDs have you installed?

CFLs: # _____
LEDs: # _____

Q11. I'm going to list some factors about the Green Partners program, and I would like you to rate them 1-5, where 1 is "Very Dissatisfied" and 5 is "Very Satisfied". How satisfied were you with:

<i>Element of Program Experience</i>	<i>Score</i>	<i>Don't Know</i>
The quality of the CFLs		<input type="checkbox"/>
Service provided by TDPUD staff		<input type="checkbox"/>
Savings on your electric bill		<input type="checkbox"/>
Information provided by TDPUD on how to save energy in your home		<input type="checkbox"/>

Overall program experience		<input type="checkbox"/>
----------------------------	--	--------------------------

For any answer less than 3, ask Q11a.

Q11a: Why did you rate [factor] at [score]? [RECORD VERBATIM]

Q12. Have you participated in any other TDPUD residential programs?

- Yes (ask Q12a) 01
- No 02
- Don't Know (Don't Read) 98

Q12a. IF YES: Which programs? [RECORD VERBATIM]

Household Characteristics / Demographics

Q13. Which of the following best describes your home/residence?

- Single Family Home, detached 01
- Single Family Home, factory manufactured/modular 02
- Single family, mobile home 03
- Condominium 04
- Apartment 05
- Other (specify) 06
- Don't know 98
- Refused 99

Q14. Do you own or rent this residence?

- Own 01
- Rent 02
- Don't know 98
- Refused 99

Q15. Approximately when was your home built? [DO NOT READ]

- | | |
|--|----|
| <input type="checkbox"/> Before 1960 | 01 |
| <input type="checkbox"/> 1960-1969 | 02 |
| <input type="checkbox"/> 1970-1979 | 03 |
| <input type="checkbox"/> 1980-1989 | 04 |
| <input type="checkbox"/> 1990-1999 | 05 |
| <input type="checkbox"/> 2000-2010 | 06 |
| <input type="checkbox"/> 2011 or later | 07 |
| <input type="checkbox"/> Don't know | 98 |
| <input type="checkbox"/> Refused | 99 |

Q16. Approximately how many square feet is your home?

- | | |
|--|----|
| <input type="checkbox"/> _____ Record Number [100-99999] | |
| <input type="checkbox"/> Don't know | 98 |
| <input type="checkbox"/> Refused | 99 |

Q17. How many individuals currently live in your home?

- | | |
|---|----|
| <input type="checkbox"/> _____ Record Number [1-97] | |
| <input type="checkbox"/> Don't know | 98 |
| <input type="checkbox"/> Refused | 99 |

Q18. What is your approximate total household income? [PROVIDE BINS]

- | | |
|---|----|
| <input type="checkbox"/> Less than \$10,000 | 01 |
| <input type="checkbox"/> \$10,000 to \$29,999 | 02 |
| <input type="checkbox"/> \$30,000 to \$49,999 | 03 |
| <input type="checkbox"/> \$50,000 to \$69,999 | 04 |
| <input type="checkbox"/> \$70,000 to \$89,999 | 05 |
| <input type="checkbox"/> \$90,000 to \$99,999 | 06 |
| <input type="checkbox"/> \$100,000 to \$149,999 | 07 |
| <input type="checkbox"/> \$150,000 or more | 08 |

<input type="checkbox"/> Don't know	98
<input type="checkbox"/> Refused	99

Q19. Do you have any comments about the Residential Green Partners Program, or any suggestions with regard to how it might be improved?

Thank you very much! Your responses will help TDPUD in improving the program.

6. Appendix B: Customer Survey for Refrigerator Recycling Program

Hello. My name is _____ with _____, and I am calling from ____ on behalf of Truckee Donner PUD, your utility service provider. I am conducting a brief survey regarding TDPUD's Refrigerator Recycling Program. Our records show that you recycled a refrigerator or freezer through the program in the past year. We would like to get some feedback from you about the program. May I ask you a few questions?

- Q1 Do you recall having one of your old refrigerators or freezers picked up for recycling and receiving a rebate from TDPUD?
- Yes
 - No [IF NO, THANK RESPONDENT AND TERMINATE INTERVIEW]
- Q2 When did you learn about the TDPUD's Refrigerator Recycling program? Was it...
- Before deciding to recycle the refrigerator/freezer (1)
 - After deciding to recycle the refrigerator/freezer (2)
 - At the same time as deciding to recycle the refrigerator/freezer (3)
 - Don't Know [DON'T READ] (98)
- Q3 Was the unit being used as your main refrigerator/freezer, or was it a secondary or spare unit?
- Main [ASK Q3a] (1)
 - Secondary or Spare [ASK Q3b] (2)
 - Don't Know [DON'T READ. SKIP TO Q4] (98)
- Q3a Why did you replace your refrigerator/freezer? [DON'T READ. MARK ALL INDICATED. PROBE FOR MULTIPLE RESPONSES. SKIP TO Q4 AFTER THIS QUESTION ANSWERED]
- Wanted a better working unit (1)
 - Wanted a newer unit (2)
 - Wanted a more efficient unit (3)
 - Wanted a different size/type (4)

- Remodeling home (5)
 - Other (Specify) _____ (6)
- Q3b Would you say that prior to recycling the refrigerator/freezer, it was... [READ ALL]
- Unplugged (skip to Q4) (1)
 - Operated for a portion of the year (ask Q3c) (2)
 - Operated year-round (skip to Q4) (3)
 - Don't know
- Q3c Approximately how many months out of the year would you estimate that the refrigerator/freezer was used in the past year?
- _____ Months (1)
 - Don't know (2)
- Q4 When the refrigerator/freezer was in use, where in the house was it set up? [PROMPT ONLY IF NECESSARY]
- Kitchen (1)
 - Den/Lounge (2)
 - Garage (3)
 - Basement (4)
 - Outdoors (5)
 - Other [SPECIFY]_____ (6)
- Q5 Did you have specific plans to dispose of the refrigerator/freezer prior to learning about the program?
- Yes (1)
 - No (2)
- Q6 When replacing a major appliance, what do you typically do with the old unit? [DO NOT READ. PROMPT ONLY IF NECESSARY]
- Keep the unit (1)
 - Sold to a private party (ask Q6a) (2)
 - Sold/gave to a used-appliance dealer (3)
 - Gave to a friend/family/neighbor (4)

- Donate it (5)
- Removed by dealer when replacement unit came (6)
- Dispose or recycle it myself (7)
- Hire someone to dispose or recycle it for me (8)
- Other [SPECIFY]_____ (9)

Q6a Are you more likely to sell the appliance in a private party sale, or to sell or trade it in to a used refrigerator dealer?

- Private Party (1)
- Used Appliance Dealer (2)
- Other [SPECIFY]_____ (3)
- Don't Know (98)

Q7 Did you attempt to sell or donate your refrigerator/freezer prior to participating in the Refrigerator Recycling Program?

- Yes [ASK Q7a] (1)
- No [SKIP TO Q8] (2)

Q7a Why did you not follow through with selling or donating the unit? [DON'T READ OPTIONS, CHECK ALL THAT APPLY]

- Couldn't find an interested buyer at the price I wanted (1)
- Couldn't find an interested buyer because of the unit's condition (2)
- Decided recycling the unit was more important than selling it (3)
- Other [SPECIFY] _____ (4)
- Don't Know (98)

Q8 What would you have done with your old appliance if you had not recycled it through the program? [DO NOT PROMPT]

- Continued to use it (1)
- Sold it (2)
- Unplugged and stored it (3)

- Disposed of it (4)
- Given it away / Donated (5)
- Other [SPECIFY] _____ (6)

Q9 What condition was the unit in when it was picked up? [READ LIST, INDICATE ONE RESPONSE]

- It worked well and was in good physical condition (normal wear and tear such as scratches, etc.) (1)
- It worked but needed minor repairs (like a door seal or handle) (2)
- It worked but had some problems (like it wouldn't defrost) (3)
- It didn't work at all (4)
- Don't Know [DON'T READ] (98)

Q10 How did you first hear about the Refrigerator Recycling Program? [DO NOT PROMPT, CHECK ALL THAT APPLY]

- Advertisement (print, radio, etc.) (1)
- TDPUD bill insert, flyer or letter (2)
- Friend or relative / Word of mouth (3)
- TDPUD website (4)
- Email from TDPUD (5)
- Other website: specify (6)
- Retailer / in-store [MARK IF RESPONDENT INDICATES IN-STORE SIGNAGE OR FROM RETAIL STAFF, OR MENTIONS A SPECIFIC RETAILER BY NAME] (7)
- Other [SPECIFY] _____ (8)
- Don't know (98)

Q11 What factors motivated you to recycle your refrigerator with the program this past year? [DO NOT READ. CHECK ALL THAT APPLY]

- The rebate (1)
- Energy cost savings (2)
- Good for the environment (3)
- Refrigerator no longer worked properly (4)
- Purchased new refrigerator or freezer (5)
- Convenience of free pickup (6)
- Other [SPECIFY] _____ (7)
- Don't Know [DON'T READ] (98)

Q12 How important was the rebate in your decision to recycle your refrigerator?

- Very Important (1)
- Somewhat Important (2)
- Slightly Important (3)
- Not at All Important (4)
- Don't Know [DON'T READ] (98)

Q13 How important was the free pickup service in your decision to recycle your refrigerator?

- Very Important (1)
- Somewhat Important (2)
- Slightly Important (3)
- Not at All Important (4)
- Don't Know [DON'T READ] (98)

Q14 How long did it take to receive your rebate? [READ IF NECESSARY]

- 2 weeks or less (1)
- 2-4 weeks (2)
- 4 or more weeks (3)
- Don't know (98)

Q15 Do you think the wait time to receive the rebate was too long?

- Yes (1)

- No (2)
- Don't know (98)

Q16 On a scale of 1 to 10, with "1" meaning "very dissatisfied" and "10" meaning "very satisfied", how satisfied were you with:

[ASK IN RANDOM ORDER, WITH ITEM (F) ALWAYS LAST]

	Score:	<i>Don't know or no answer</i>
A. The scheduling process for recycling		<input type="checkbox"/>
B. The service performed by staff that picked up your refrigerator		<input type="checkbox"/>
C. The wait time between scheduling and pick-up of the refrigerator		<input type="checkbox"/>
D. The wait time to receive the rebate		<input type="checkbox"/>
E. The rebate amount		<input type="checkbox"/>
F. Overall program experience		<input type="checkbox"/>

[IF ANY ITEM <5, ASK Q17. OTHERWISE SKIP TO Q-18]

Q17 Why were you dissatisfied with [COMPONENT SCORED < 5]? [ENTER VERBATIM RESPONSE]

Q18 TDPUD often has a table at local community events where they hand out CFL bulbs to those in attendance. Did you receive any CFL bulbs during any event held throughout the last year?

- Yes (ask Q19) (1)
- No (skip to Q23) (2)
- Don't know (98)

Q19 How many CFL bulbs were you given at the event?

- Record number _____
- Don't know (98)

Q20 How many of those CFLs bulbs did you install?

- Record number _____
- Don't know/remember (98)

Q21 Where in your home did you install the CFL bulbs?

- Living room
- Kitchen
- Dining room
- Entry/Hallway
- Bedroom
- Bathroom
- Garage
- Outdoors
- Closet
- Office
- Other

Q22 Were the CFLs bulbs installed in Truckee or somewhere else?

- Truckee (1)
- Other city (2)
- Don't know (98)

Household Characteristics / Demographics

Q23 Which of the following best describes your home/residence?

- Single Family Home, detached construction
- Single Family Home, factory manufactured/modular
- Single family, mobile home
- Condominium

- Apartment
- Other (specify)
- Don't know
- Refused

Q24 What type of cooling system do you have for your home? Do you have a...
[READ LIST, ONE ANSWER ONLY]

- Central air conditioning system (1)
- Evaporative cooling system or a swamp cooler (2)
- Window air conditioner (3)
- No cooling system [DON'T READ] (4)
- Don't Know [DON'T READ] (98)

Q25 Do you own or rent this residence?

- Own
- Rent
- Don't know
- Refused

Q26 Approximately when was your home constructed? [DO NOT READ]

- Before 1960
- 1960-1969
- 1970-1979
- 1980-1989
- 1990-1999
- 2000-2010
- 2011 or later
- Don't know
- Refused

Q27 Approximately how many square feet is your home?

- _____ Record Number [100-99999]
- Don't know
- Refused

Q28 How many individuals currently live in your home?

- _____ Record Number [1-97]
- Don't know
- Refused

Q29 What is your approximate total household income? [PROVIDE BINS]

- Less than \$10,000
- \$10,000 to \$29,999
- \$30,000 to \$49,999
- \$50,000 to \$69,999
- \$70,000 to \$89,999
- \$90,000 to \$99,999
- \$100,000 to \$149,999
- \$150,000 or more
- Don't know
- Refused

Q30 Do you have any comments about the Refrigerator Recycling program, or any suggestions with regard to how it might be improved?

Thank you very much! Your responses will help TDPUD in improving the program.

8. Appendix C: Customer Survey for RES/ESP Program

Hello. My name is ___ and I'm calling from ADM Associates on behalf of TDPUD. We are conducting a study of the Residential Energy Survey [Energy Savings Partners] Program, through which you've received an audit and direct install measures for energy and water efficiency improvements. TDPUD will use this information to help them improve the program. The interview will take approximately 15 minutes. May I ask you a few questions?

Customer Name: _____

Date of interview: _____

.....

Q-1 Our records indicate that you received a survey and directly installed fixtures from TDPUD in your home. Is this correct?

- Yes *(If checked, go to Q-2)*
- No *(If checked, thank respondent and terminate interview)*
- Don't know *(If checked, ask to speak with someone in the home who may know)*

Q-2 After the surveyor came to your home, what energy or water fixtures were installed? [CHECK ALL THAT ARE MENTIONED]

- CFLs 01
- LEDs 02
- Low-flow showerhead(s) 03
- Faucet aerator(s) 04
- Hose spray nozzle 05
- Weather stripping 06
- Door sweeps 07
- Hot water piping insulation 08
- Water heater jacket 09
- Don't know/unsure 98

Q-2 How did you first hear about the RES/ESP program?

[DO NOT READ. Check all mentioned. Prompt only if necessary. Probe as needed.]

- At the utility office/from program staff 01
- Print ad/flyer 02
- Word-of-mouth 03
- TV/radio ad 04
- Bill insert/brochure/message 05
- TDPUD website 06
- Community/local event 07
- Other (*Specify*) 08
- Don't know 98

Q-3 Why did you participate in the RES/ESP Program?

[DO NOT READ. Check all mentioned. Prompt only if necessary. Probe as needed.]

- To save energy 01
- To reduce our utility bill 02
- Because services were free of charge 03
- Good for the environment 04
- Because you had trouble paying your utility bill 05
- Indoor air quality/health issues 06
- Property manager wanted you to 07
- Recommendation of a friend/relative 08
- Other (*Specify*) 09
- Don't know 98

Q-3A Of the things you mentioned, which was the most important?

- To save energy 01
- To reduce our utility bill 02
- Because services were free of charge 03

- Good for the environment 04
- Because you had trouble paying your utility bill 05
- Indoor air quality/health issues 06
- Property manager wanted you to 07
- Recommendation of a friend/relative 08
- Other (*Specify*) 09
- Don't know 98

DIRECT INSTALL COMPONENTS

Now I'm going to ask you some questions about the energy and/or water fixtures that were installed in your home.

[CFLs]

[ASK IF Q2 = 01 IS CHECKED]

Q-4 How many CFLs were installed in your home? [MAX COMBO = 24 bulbs]

- #_____
- Don't know [DON'T READ] 98

Q-5 Are there any CFLs that have not been installed?

- Yes (ask Q-5A) 01
- No 02
- Don't know 98

Q-5A How many of those CFLs have not been installed?

- #_____
- Don't know [DON'T READ] 98

Q-6 Of those CFLs that were installed in your home, did the surveyor install the CFLs or did you install them yourself?

- The surveyor installed them (ask Q-7) 01

- I installed them (skip to Q-8) 02
- The surveyor installed some and I installed some 03
- Unsure/Don't know 98

[IF SURVEYOR INSTALLED]

Q-7 On a scale of 1-5, where 1 means “not at all satisfied” and 5 means “very satisfied”, how satisfied were you with the installation of the CFLs by the surveyor?

- #_____
- Don't know [DON'T READ] 98

Q-8 On a scale of 1-5, where 1 means “not at all satisfied” and 5 means “very satisfied”, how satisfied were you with the CFLs?

- #_____
- Don't know [DON'T READ] 98

Q-9 Do you think the CFLs are higher quality, the same quality, or lower quality than what you had before?

- Higher 01
- Same 02
- Lower (ask Q9a) 03
- Don't know 98

Q-9a Could you clarify why you thought the CFLs were lower quality? [RECORD VERBATIM]

Q-10 Have you removed any of the CFLs?

- Yes (ask Q-10a and Q11) 01
- No 02
- Don't know 98

Q10a How many CFLs did you remove?

- #_____
- Don't know [DON'T READ] 98

Q-11 Why did you remove them? [DON'T READ. CHECK ALL INDICATED]

- They were not bright enough 01
- I didn't like the color 02
- I didn't like them 03
- Wanted something else 04
- Stopped working 05
- Other (specify) 06
- Don't know 98

[LEDs]

[ASK IF Q2 = 02 IS CHECKED]

Q-12 How many LEDs were installed in your home? [MAX = 2 bulbs]

- #_____
- Don't know [DON'T READ]

Q-13 Are there any LEDs that have not been installed?

- Yes (ask Q-13A) 01
- No 02
- Don't know 98

Q-13A How many of those LEDs have not been installed?

- #_____
- Don't know [DON'T READ] 98

Q-14 Of those LEDs that were installed, did the surveyor install the LEDs or did you install them yourself?

- The surveyor installed (ask Q-15) 01
- I installed (skip to Q-16) 02
- Don't know 98

[IF SURVEYOR INSTALLED]

Q-15 On a scale of 1-5, where 1 means “not at all satisfied” and 5 means “very satisfied”, how satisfied were you with the installation of the LEDs by the surveyor?

- #_____
- Don't know [DON'T READ] 98

Q-16 On a scale of 1-5, where 1 means “not at all satisfied” and 5 means “very satisfied”, how satisfied were you with the LEDs?

- #_____
- Don't know [DON'T READ] 98

Q-17 Do you think the LEDs are higher quality, the same quality, or lower quality than what you had before?

- Higher 01
- Same 02
- Lower (ask Q17a) 03
- Don't know 98

Q-17a Could you clarify why you thought the LEDs were lower quality? [RECORD VERBATIM]

Q-18 Have you removed any of the LEDs?

- Yes (ask Q-19) 01
- No 02
- Don't know 98

Q-19 Why did you remove them? [DON'T READ. CHECK ALL INDICATED]

- They were not bright enough 01
- I didn't like the color 02
- I didn't like them 03
- Wanted something else 04

- Stopped working 05
- Other (specify) 06
- Don't know/Refused to answer 98

[LOW-FLOW SHOWERHEADS]

[ASK IF Q2 = 03 IS CHECKED]

Q-20 How many low-flow showerheads were installed in your home?

- #____ [MAX = 2]
- Don't know [DON'T READ] 98

Q-21 Did the surveyor install the showerheads or did you install them yourself?

- The surveyor installed them (ask Q-21a) 01
- I installed them (skip to Q-22) 02
- Unsure/Don't know 98

Q-21a On a scale of 1-5, where 1 means "not at all satisfied" and 5 means "very satisfied", how satisfied were you with the installation of the showerhead(s)?

- #____
- Don't know [DON'T READ] 98

Q-22 On a scale of 1-5, where 1 means "not at all satisfied" and 5 means "very satisfied", how satisfied were you with the showerhead(s)?

- #____
- Don't know [DON'T READ] 98

Q-23 Have you removed any of them?

- Yes (Q-23a and Q24) 01
- No 02
- Don't know 98

Q-24 Why did you remove them? [DON'T READ. CHECK ALL INDICATED]

- Not enough flow 01
- Didn't like the spray 02

- Wanted one with a hose 03
- Didn't like the look 04
- Stopped working 05
- Other (specify) 06
- Don't know/Refused to answer 98

[FAUCET AERATORS]

[ASK IF Q2 = 04 IS CHECKED]

Q-25 How many faucet aerators were installed in your home?

- #_____
- Don't know [DON'T READ] 98

Q-26 Did the surveyor install the faucet aerators or did you install them yourself?

- The surveyor installed them (ask Q-26a) 01
- I installed them (skip to Q-27) 02
- Unsure/Don't know 98

Q-26a On a scale of 1-5, where 1 means "not at all satisfied" and 5 means "very satisfied", how satisfied were you with the installation of the faucet aerator(s)?

- #_____
- Don't know [DON'T READ] 98

Q-27 On a scale of 1-10, where 1 means "not at all satisfied" and 10 means "very satisfied", how satisfied were you with the faucet aerator(s)?

- #_____
- Don't know [DON'T READ] 98

Q-28 Have you removed any of them?

- Yes (Q-29) 01
- No 02
- Don't know 98

Q-29 Why did you remove them? [DON'T READ. CHECK ALL INDICATED]

- Not enough flow 01
- Didn't like the spray 02
- Didn't like the look 03
- Stopped working 04
- Other (specify) 05
- Don't know/Refused to answer 98

[WEATHER STRIPPING]

[ASK IF Q2 = 05 IS CHECKED]

Q-30 Did you have weather stripping installed in your home?

- Yes 01
- No 02
- Don't know 98

Q-31 Did the surveyor install the weather stripping or did you install it yourself?

- The surveyor installed them (ask Q-31a) 01
- I installed them (skip to Q-32) 02
- Unsure/Don't know 98

Q-31a On a scale of 1-5, where 1 means "not at all satisfied" and 5 means "very satisfied", how satisfied were you with the installation of the weather stripping?

- #_____
- Don't know [DON'T READ] 98

Q-32 On a scale of 1-5, where 1 means "not at all satisfied" and 5 means "very satisfied", how satisfied were you with the weather stripping?

- #_____
- Don't know [DON'T READ] 98

Q-33 Have you removed it?

- Yes (Q-34) 01
- No 02

Don't know 98

Q-34 Why did you remove it?

RECORD VERBATIM

Don't know/Refused to answer 98

[DOOR SWEEP]

[ASK IF Q2 = 06 IS CHECKED]

Q-35 Did you have a door sweep installed in your home?

Yes 01

No 02

Don't know 98

Q-36 Did the surveyor install it or did you install it yourself?

The surveyor installed them (ask Q-36a) 01

I installed them (skip to Q-37) 02

Unsure/Don't know 98

Q-37a On a scale of 1-5, where 1 means "not at all satisfied" and 5 means "very satisfied", how satisfied were you with the installation of the door sweep?

#_____

Don't know [DON'T READ] 98

Q-38 On a scale of 1-10, where 1 means "not at all satisfied" and 5 means "very satisfied", how satisfied were you with the door sweep?

#_____

Don't know [DON'T READ] 98

Q-39 Have you removed it?

Yes (Q-40) 01

No (skip to Q41) 02

Don't know 98

Q-40 Why did you remove it?

- RECORD VERBATIM
- Don't know/Refused to answer 98

[HOT WATER PIPING INSULATION]

[ASK IF Q2 = 07 IS CHECKED]

Q-41 Did you have hot water piping insulation installed in your home?

- Yes 01
- No 02
- Don't know 98

Q-42 Did the surveyor install it or did you install it yourself?

- The surveyor installed them (ask Q-42a) 01
- I installed them (skip to Q-43) 02
- Unsure/Don't know 98

Q-42a On a scale of 1-5, where 1 means "not at all satisfied" and 5 means "very satisfied", how satisfied were you with the installation of the hot water piping insulation?

- #_____
- Don't know [DON'T READ] 98

Q-43 On a scale of 1-10, where 1 means "not at all satisfied" and 5 means "very satisfied", how satisfied were you with the hot water piping insulation?

- #_____
- Don't know [DON'T READ] 98

Q-44 Have you removed it?

- Yes (ask Q45) 01
- No (skip to Q46) 02
- Don't know 98

Q-45 Why did you remove it?

- RECORD VERBATIM
- Don't know/Refused to answer 98

EXPERIENCE WITH SURVEYOR

Q-46 Was your surveyor professional and knowledgeable?

- Yes 01
- No 02
- Don't know 98

Q-47 Using the 1-5 scale, where 1 means "strongly disagree" and 5 means "strongly agree", please rate your experience with the installation work done on your home by the surveyor.

#_____

- Don't know [DON'T READ] 98

Q-48 Have you noticed a decrease in your utility electric and/or water bill since participating in the program?

- Yes – electric 01
- Yes – water 02
- Yes – both 03
- No 04
- Don't know 98

Q-49 Did you have plans to make these improvements to your home prior to learning about the program?

- Yes 01
- No 02
- Don't know 98

Q-50 Would you have been financially able to make these home improvements without the incentive from the utility?

- Yes 01

- No 02
- Don't know 98

Q-51 If the services from the RES/ESP program were not available, how likely would you have been to install the same home improvements? [READ, MARK ONE]

- Definitely would have installed 01
- Probably would have installed 02
- Probably would not have installed 03
- Definitely would not have installed 04
- Don't know (*don't read*) 98

Q-52 On a scale of 0 to 5, where "5"; is very satisfied , "0" is very dissatisfied, how would you rate the following? [RANDOMIZE. ASK "OVERALL PROGRAM EXPERIENCE" LAST]

<i>Element of Program Experience</i>	<i>Score</i>	<i>Don't Know</i>
A. Information provided by the surveyor		<input type="checkbox"/>
B. The quality of installation work by the surveyor [SKIP IF SELF-INSTALLED]		<input type="checkbox"/>
C. The savings on your monthly bill		<input type="checkbox"/>
D. The service provided by utility staff		<input type="checkbox"/>
E. Information provided by TDPUD on how to reduce your utility bill		<input type="checkbox"/>
F. Improvement in home comfort after receiving the home improvements		<input type="checkbox"/>
G. Overall program experience		<input type="checkbox"/>

[FOR ANY PROGRAM ELEMENT SCORED < 3]

Q-52a Why were you dissatisfied with [Program Element]?

Q53 Which of the following best describes your home/residence?

- | | |
|---|----|
| <input type="checkbox"/> Single Family Home, detached construction | 01 |
| <input type="checkbox"/> Single Family Home, factory manufactured/modular | 02 |
| <input type="checkbox"/> Single family, mobile home | 03 |
| <input type="checkbox"/> Condominium | 04 |
| <input type="checkbox"/> Apartment | 05 |
| <input type="checkbox"/> Other (specify) | 06 |
| <input type="checkbox"/> Don't know | 98 |
| <input type="checkbox"/> Refused | 99 |

Q54 Do you own or rent this residence?

- | | |
|-------------------------------------|----|
| <input type="checkbox"/> Own | 01 |
| <input type="checkbox"/> Rent | 02 |
| <input type="checkbox"/> Don't know | 98 |
| <input type="checkbox"/> Refused | 99 |

Q-55 Approximately when was your home built? [IF RESPONDENT DOES NOT GIVE VERBATIM ANSWER, READ OFF YEAR RANGES UNTIL RESPONDENT INDICATES ONE]

- | | |
|--|----|
| <input type="checkbox"/> Before 1960 | 01 |
| <input type="checkbox"/> 1960-1969 | 02 |
| <input type="checkbox"/> 1970-1979 | 03 |
| <input type="checkbox"/> 1980-1989 | 04 |
| <input type="checkbox"/> 1990-1999 | 05 |
| <input type="checkbox"/> 2000-2010 | 06 |
| <input type="checkbox"/> 2011 or later | 07 |

- Don't know 98
- Refused 99

Q56 Approximately how many square feet is your home?

- _____ Record Number [100-99999]
- Don't know 98
- Refused 99

Q57. How many individuals currently live in your home?

- _____ Record Number [1-97]
- Don't know 98
- Refused 99

Q-58 Do you have any comments about the RES/ESP Program, or any suggestions with regard to how it might be improved?

Thank you very much! Your responses will help TDPUD in improving the program.

Q3. Have you purchased any CFLs (compact fluorescent bulbs) during the past year?

- Yes [ask Q3a]
- No
- Don't know
- Refused

Q3a How many?

- # _____

Q4. Have you purchased any LEDs (light emitting diode bulbs) during the past year?

- Yes [ask Q4a]
- No [skip to Q5]
- Don't know
- Refused

Q4a How many?

- # _____

In-Service Rate

Q5A. How many of those CFLs would you estimate you installed?

- _____ [RECORD NUMBER. IF RESPONDENT SAYS "100%" or "ALL", THEN SKIP TO Q6A]
- Don't recall
- Refused

Q5B. How many of those LEDs would you estimate you installed?

- _____ [RECORD NUMBER. IF RESPONDENT SAYS "100%" or "ALL", THEN SKIP TO Q6B]

- Don't recall
- Refused

Q6A. Are there any CFL bulbs you purchased in the past six months that you have not installed or are saving for a later date?

- Yes, have some left [GO TO Q7A]
- None [GO TO Q8]
- Don't know [GO TO Q8]
- Refused [GO TO Q8]

Q6B. Are there any LED bulbs you purchased in the past six months that you have not installed or are saving for a later date?

- Yes, have some left [GO TO Q7B]
- None [GO TO Q8]
- Don't know [GO TO Q8]
- Refused [GO TO Q8]

Q7A. How many of those CFLs purchased did you save to install at a later date? [If respond is unsure, say "Your best estimate is okay."]

- _____ [RECORD NUMBER, 0 – 97.]
- Don't recall
- Refused

Q7B. How many of those LEDs purchased did you save to install at a later date? [If respond is unsure, say "Your best estimate is okay."]

- _____ [RECORD NUMBER, 0 – 97.]
- Don't recall
- Refused

Purchase Reasoning

Q8. Why did you purchase the CFLs?

[DO NOT READ RESPONSES. RECORD ALL RESPONSES. IF respondent says “I needed bulbs” or similar, PROMPT for more detailed explanation.]

- Replaced burned out bulbs
- Replace working bulbs, wanted to lower energy usage
- Installed in a new light fixture or lamp socket
- Improve lighting quality/brighten a room
- Replaced burned out bulbs & working bulbs at same time
- Stock up on bulbs
- Good deal prompted purchase
- Other (describe)_____
- Don't recall
- Refused

Q8a. [ASK IF Q3 = 01] Why did you decide to purchase CFL bulbs instead of another type of bulb, such as an LED bulb?

- CFLs were the cheapest option
- CFLs were the only bulb type available at the store
- CFLs were the closest match to the bulb I was replacing
- I saw the CFLs first
- I prefer the lighting quality of CFLs
- I prefer the features associated with CFLs, such as dimming, instant on, color change, smart controls, etc.
- CFLs last longer than other bulbs
- Other (describe)_____
- Don't recall
- Refused

Q9. Why did you purchase the LEDs?

[DO NOT READ RESPONSES. RECORD ALL RESPONSES. IF respondent says “I needed bulbs” or similar, PROMPT for more detailed explanation.]

- Replaced burned out bulbs
- Replace working bulbs, wanted to lower energy usage
- Installed in a new light fixture or lamp socket
- Improve lighting quality/brighten a room
- Replaced burned out bulbs & working bulbs at same time
- Stock up on bulbs
- Good deal prompted purchase
- Other (describe)_____
- Don't recall
- Refused

Q9a. [ASK IF Q4 = 01] Why did you decide to purchase LEDs instead of another type of bulb, such as a CFL bulb?

- LEDs were the cheapest option
- LEDs were the only bulb type available at the store
- LEDs were the closest match to the bulb I was replacing
- I saw the LEDs first
- I prefer the lighting quality of LEDs
- I prefer the features associated with LEDs, such as dimming, instant on, color change, smart controls, etc.
- LEDs last longer than other bulbs
- Other (describe)_____
- Don't recall
- Refused

Bulb Types Replaced

Q10. [ASK IF Q3 = 01] Now I would like you to think about the types of bulbs the CFLs replaced. Did they replace typical incandescent light bulbs, old CFL light bulbs, some other type of existing bulb, or a combination of old bulb types?

- Incandescent
- Existing CFLs
- LEDs
- Other :_____ [VERBATIM]
- Mixture:_____ [VERBATIM]
- Don't know
- Refused

Q11. [ASK IF Q4 = 01] Now I would like you to think about the types of bulbs the LEDs replaced. Did they replace typical incandescent light bulbs, old LED light bulbs, some other type of existing bulb, or a combination of old bulb types?

- Incandescent
- CFLs
- Existing LEDs
- Other :_____ [VERBATIM]
- Mixture:_____ [VERBATIM]
- Don't know
- Refused

Q12. When purchasing light bulbs, what is the most important characteristic you consider when selecting a particular style, brand, or package to buy?

[DO NOT READ RESPONSES. RECORD ALL RESPONSES GIVEN. PROMPT IF NECESSARY.]

- Cost
- Energy efficiency

- Color/style of light
- Brightness of the bulb
- Brand
- How long the bulb lasts before replacement
- Other (specify)_____
- Don't recall
- Refused

Q12A. [If more than one reason listed] Of all the reasons you listed, which is the most important?

- Cost
- Energy efficiency
- Color/style of light
- Brightness of the bulb
- Brand
- How long the bulb lasts before replacement
- Other (specify)_____
- Don't recall
- Refused

Q13. On a scale of one to five, where one is "not important at all" and five is "very important," how important is energy efficiency to you when you select light bulbs for purchase?

- _____ [Record number, 1-5]
- Don't know
- Refused

Awareness of Discounts

Q14. How did you become aware of the TDPUD lighting discounts? [MARK ALL THAT APPLY]

- In-store promotional event representative
- In-store signage/marketing materials
- Store salesperson
- TDPUD website
- TDPUD program staff
- Word of mouth
- Other: _____ (describe)
- Don't know
- Refused

Q15. When purchasing CFL or LED light bulbs in the past six months, do you recall any of the products being discounted from their normal pricing?

- Yes (ask Q15a) 01
- No 02
- Don't know 98
- Refused 99

Q15a. Do you recall who the discounts were offered by?

- Yes (ask Q15b) 01
- No 02
- Don't know 98
- Refused 99

Q15b. Please specify: _____

Q16. Would you have been financially able to purchase the bulbs without the discount?

- Yes
- No
- Don't know

Q17. If the rebate incentives were not available, how likely would you have been to purchase the CFLs or LEDs bulbs? [READ, MARK ONE]

- Definitely would have purchased
- Probably would have purchased
- Probably would not have purchased
- Definitely would not have purchased
- Don't know (don't read)

Q18. On a scale of 1 to 5, where 1 is "not important at all" and 5 is "very important," how important was the TDPUD lighting discount to your decision to purchase those specific light bulbs?

- _____ [Record number, 1-5]
- Don't recall
- Refused

Household Characteristics / Demographics

Q19. Which of the following best describes your home/residence?

- Single Family Home
- Single family, mobile home
- Condominium
- Apartment
- Other (specify)
- Don't know
- Refused

Q20. Do you own or rent this residence?

- Own
- Rent
- Don't know
- Refused

Q21. Approximately when was your home constructed? [DO NOT READ]

- Before 1960
- 1960-1969
- 1970-1979
- 1980-1989
- 1990-1999
- 2000-2010
- 2011 or later
- Don't know
- Refused

Q22. Approximately how many square feet is your home?

- _____ Record Number [100-99999]
- Don't know
- Refused

Q23. How many individuals currently live in your home?

- _____ Record Number [1-97]
- Don't know
- Refused

Q24. What is your approximate total household income? [PROVIDE BINS]

- Less than \$10,000
- \$10,000 to \$29,999
- \$30,000 to \$49,999
- \$50,000 to \$69,999
- \$70,000 to \$89,999
- \$90,000 to \$99,999
- \$100,000 to \$149,999
- \$150,000 or more
- Don't know
- Refused

Q25. Do you have any comments about the Residential Lighting Rebate program, or any suggestions with regard to how it might be improved?

Thank you very much! Your responses will help TDPUD in improving the program.

10. Appendix E: Customer Survey for Million CFLs Program

Q1 TDPUD often has a table at local community events where they hand out CFL bulbs to those in attendance. Did you receive any CFUL bulbs during any event held throughout the last year?

- Yes (1)
- No (2)
- Don't know (98)

Q2 How many CFL bulbs were you given at the event?

- Record number
- Don't know (98)

Q3 How many of those CFLs bulbs did you install?

- Record number
- Don't know/remember (98)

Q4 Where in your home did you install the CFL bulbs?

- Living room
- Kitchen
- Dining room
- Entry/Hallway
- Bedroom
- Bathroom
- Garage
- Outdoors
- Closet

- Office
- Other

Q5 Were the CFLs bulbs installed in Truckee or somewhere else?

- Truckee (1)
- Other city (2)
- Don't know (98)