

# **SDG&E Hard-to-Reach Lighting Turn-In Program**

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# SDG&E Hard-to-Reach Lighting Turn-In Program

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## 1. Executive Summary

This report summarizes the results of the evaluation of San Diego Gas and Electric's Hard to Reach Lighting Turn-In Program. The program provides incentives to residential customers by distributing free energy efficient compact fluorescent bulbs (CFLs) or fluorescent torchiere lamps by exchanging up to 10 inefficient 75-Watt or higher regular incandescent bulbs and two halogen torchiere floor lamps. The program's two-year goals included the distribution of 94,626 27-Watt CFLs and 4,400 torchiere fixtures. Expected savings from the program total over 816 kW and 5.19 million kWh per year.

### ***Evaluation Approach***

The primary objective of this evaluation was to verify the energy savings and demand reduction through verification of the number of measures installed. A secondary objective was to assess the success in implementing the program as designed, including determining customer satisfaction and the degree to which the program influenced future energy efficiency actions.

To meet these objectives, the evaluation research included a series of discrete tasks.

- **Participant Surveys.** Participant data were collected by SDG&E at the time of the lighting exchange. Itron compiled samples of data used for contacting the participants and categorizing their responses. The results from the participant survey were used to develop a clear picture of whether the program theory was met and whether there is a continuing need for the program.
- **Impact Verification.** Key assumptions used in the savings estimates include whether the lights are in place and being used, and the locations and hours of use of the lamps. The survey addressed both assumptions through a series of questions related to whether the units are installed and operational, and where the installed units are currently located. The stated location was matched with estimates of hours of use for each location obtained from recent lighting metering studies conducted in California.
- **Process Evaluation.** One objective of the project was to assess the program's delivery system and the resulting customer satisfaction. The team focused on several program features, including the reasons for participating in the program, the satisfaction with the various components of the program, the perceived strengths and weaknesses of the program, and suggestions for improvement.

## **Results**

The results of this study are divided into an impact evaluation and a process evaluation. The first year of the program consisted of one round of mailings, which resulted in 579 returned surveys. Of these, 567 were incorporated in the impact evaluation and all were included in the process evaluation. The second year of the program consisted of two rounds of mailings, which resulted in 364 returned surveys. Of these, 349 were incorporated in the impact evaluation, and all were included in the process evaluation.

### **Impact Evaluation**

Participants were asked how many lights they received, how many were installed, where they were installed, and the number that went uninstalled. The gathered data were compared to the data reported by SDG&E. Over the course of the two-year program, the survey participants reported installing 595 torchiere fixtures, but not installing an additional 33 fixtures. For these participants, SDG&E recorded distributing 644 torchiere fixtures. Surveyed participants reported installing 3,702 CFLs and receiving, but not installing, an additional 847. SDG&E recorded distributing 4,933 CFLs for corresponding participants. The discrepancies between surveyed bulb counts and SDG&E tracking system bulb counts were accounted for in the analysis by creating a ratio of surveyed:tracked bulbs by measure and applying this ratio to the participant population. At 27%, the bedroom was the most common area for installing the lamp, followed by the living room (20%), bathroom (13%), and kitchen (12%). The most common area for the installing torchiere fixtures was the living room (44%), followed by the bedroom (38%). Although the number of lamps installed by technology was lower than what the program claimed, the hours of operation and/or the coincident diversity factor were updated using the California Baseline Lighting Efficiency Technology Report, which significantly increased the energy savings achieved by the program.

The net post savings from CFLs distributed through the program totaled over 3 million kWh. The net ex post savings from torchieres distributed through the program totaled 1.5 million kWh. In total, the program has a net ex post savings of 4.54 million kWh, which is 12.5% lower than the goal of saving 5.19 million kWh.

### **Process Evaluation**

The respondents were asked a series of questions regarding their experience with the program in general, and specifically their experience at the turn-in event location. When asked what they liked most about the program, the most commonly mentioned aspect was the ease of participation, with 235 participants citing the simplicity as the most favorable aspect. Free bulbs were cited by 203 participants as a favorable aspect of the program. Becoming more energy efficient was also often cited, along with the prospect of saving money on future

energy bills. When asked what they liked least about their experience with the program, the most common complaint was the length of the wait. Asked to rate their overall satisfaction with the program on a scale from 1 to 10, with 1 indicating “very dissatisfied,” and 10 indicating “very satisfied” over 80% of respondents rated the program an 8 or above, and just over 50% gave the program a 10. Only 7% gave the program a 1, indicating that they were very dissatisfied.

Slightly more than half the participants indicated that their awareness of energy had efficiency increased “significantly” and 76% of participants indicated that they would install CFLs again when the units received through the program burned out. The respondents also were asked for any suggestions for improving the program. The most frequently given response was that the program was great and SDG&E should hold more events. Another common suggestion was to include more bulb/torchiere styles to choose from at the events.

### **Cost-Effectiveness**

The evaluation used the program workbooks published on SDG&E’s website. The program had a resulting TRC ratio of 1.79 compared to a projected TRC ratio of 1.66, indicating that the program is more cost-effective than estimated.

## **2. Introduction**

The program is designed to help hard-to-reach residential customers achieve long-term annual energy savings and peak demand reductions through lighting retrofits. Hard-to-reach customers often have limited resources to increase their energy efficiency and often need help in overcoming barriers such as the initial implementation costs, the need for credible information, and advice in English and other languages.

SDG&E is providing incentives to hard-to-reach residential customers by participating in events at hospitals, churches, senior centers, and other community events. Additionally, SDG&E customers are reached through partnerships with local community groups and through information provided as part of other energy efficiency programs. In the first year of the program, customers can exchange up to 10 inefficient 75-Watt or higher regular incandescent bulbs for free energy efficient CFLs. The second year of the program limits the maximum number of bulbs that can be exchanged to five. For both program years, the customers can also exchange up to two halogen torchiere floor lamps for energy efficient fluorescent torchiere lamps.

Expected savings from the program will total over 5.19 million kWh for an estimated useful life (EUL) of eight years for compact fluorescents and 16 years for torchieres, assuming a net-to-gross (NTG) ratio of 0.80

## **2.1 Project Objectives**

In line with the Energy Efficiency Policy Manual (EPPM), Version 2, August 2003, and in adherence with the International Performance Measurement and Verification Protocol (IPMVP), revised March 2002, the study had several key objectives:

- Verifying the number of measures installed,
- Calculating estimates of energy savings and demand reduction,
- Analyzing the success in implementing the program as designed,
- Determining customers' satisfaction with the program(s), and
- Determining the degree to which the program(s) influenced energy efficiency actions.

To verify the program savings, the RFP indicates that, as a minimum, the plan will verify measure installations. However, as described in the proposal, Itron recommended several additional steps to help verify the estimates of energy savings and demand reduction including identifying the location of lamp installed, the hours of operation, and other factors affecting realized savings.

The EPPM states that some or all of the eight evaluation, measurement and verification objectives listed in Table 1 must be met. Each objective is followed by a brief explanation of how this evaluation effort met the objective.

**Table 1: Policy Evaluation Objectives**

| Energy Efficiency Policy Manual Objective   | Itron EM&V Approach  |
|---|--|
| Measuring level of energy and peak demand savings achieved  | Verified number of measures installed via mail-in survey.<br>Verified location of measures via mail-in survey.<br>Estimated hours of operation using secondary data.   |
| Measuring cost-effectiveness  | <ol style="list-style-type: none"> <li>1. Ex ante EUL from EEPM V2 P. 17:               <ol style="list-style-type: none"> <li>A. CFL screw-in: 8 yrs.</li> <li>B. CFL hardware fixture: 16 yrs.</li> </ol> </li> <li>2. Ex ante net-to-gross ratio from EEPM V@ P. 19: 0.80.</li> <li>3. Adjusted only if response from surveys suggests significant free ridership or spillover.</li> </ol>  |
| Providing up-front market assessments and baseline analysis, especially for new programs  | This evaluation did not include a market assessment, although a limited Market Assessment characterization of participants is provided through participant survey responses to selected questions. <sup>1</sup> The baseline for this program will be assessed for reasonableness, but most parameters will not be analyzed under this evaluation. Sources for this assessment are provided in Section 2 below, under the subsection titled Verifying Impacts. |
| Providing ongoing feedback, and corrective and constructive guidance regarding the implementation of programs.                                      | Itron will provide ongoing feedback and guidance for the CFL Turn-In Program.  |
| Measuring indicators of the effectiveness of specific programs, including testing of the assumptions that underlie the program theory and approach. | Participants were surveyed regarding their perceptions, expectations, and satisfaction about various program components.   |
| Assessing the overall levels of performance and success of programs   | Annual impact estimates were developed by technology and location for each participant and then aggregated to the population using equations presented in Section 2.   |
| Informing decisions regarding compensation and final payments   | Net energy and demand savings estimates will be reported to the CPUC.  |
| Helping to assess whether there is a continuing need for the program  | Program accomplishments and attainment of energy savings goals will be used to help qualitatively assess the continuing need for the program (i.e., if the program is fully subscribed and potential participants are turned away then this is an indicator of a continuing need for the program.  |

<sup>1</sup> From the California Evaluation Framework, June 2004: Market assessments and market baseline analysis are generally conducted through market transformation program evaluations. These broad, market-wide evaluations are used as a reference to establish program-specific baselines. Each program is responsible for determining the appropriate baseline conditions for the program’s operation and evaluation. Impact evaluations generally rely on a clear definition of the program baseline, though baseline analyses are generally not conducted as a component of impact evaluation.

### **3. Methodology**

This section describes the study requirements considered in the design of the program evaluation.

#### ***Impact Evaluation***

A primary project goal was to verify program savings, as described under Task 3 below.

#### **Identification of Participants**

Participants were identified through the completed applications required at the time of the lighting exchange. These applications were entered by SDG&E into a database that was periodically delivered to Itron. Itron compiled samples of data based on name, addresses, telephone number, SDG&E account number, language of preference, fixture counts, and other relevant information. This information was used for contacting the customers for surveys and categorizing the responses (e.g., ZIP codes of respondents).

#### **Verifying Impacts**

Key assumptions used in the savings estimates include (1) whether the lights are in place and being used, and (2) the locations and hours of use of the lamps. The survey addressed both assumptions through a series of questions related to whether the units are installed and operational and where the installed units are currently located (e.g., living room, bedroom, closet, or outdoors). The stated location was compared with estimates of hours of use for each location and the explicit or implicit locations assumed in the SDG&E work papers. The following external data sources that were reviewed for inclusion in the baseline analysis.

- SDG&E work papers.
- Evaluation of the 2002-2003 Statewide Crosscutting Residential Lighting Program, Kema-Xenergy, 2003.<sup>2</sup>
- California Lamp Trends 2003, Itron, Inc., 2003.
- California Residential Efficiency Market Share Tracking; New Construction 2001, Regional Economic Research, Inc., 2001.
- Database for Energy Efficient Resources (DEER), 2004.

Annual impact estimates were developed by technology and location for each participant for the following conditions.

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<sup>2</sup> This study includes a sample of approximately 400 homes statewide with approximately three lighting loggers per home. Data collection was completed in the fourth quarter of 2004 with results available in the first quarter of 2005. Room-specific hours of operation from this study were utilized in this evaluation.



- **Ex ante gross impact estimate.** Ex ante gross savings were estimated using program and participation data in the following formula:

$$kWh_{ex\ ante,t} = (kW_{pre,t} - kW_{post,t}) * \#Fixtures_t * Hours / yr_t$$

where:

$t$  = technology (CFL or torchiere)

- **Ex ante net impact estimate.** Ex ante net savings were estimated by multiplying the ex ante gross impact estimate by the net-to-gross ratio provided in the SDG&E program workbook, as follows:

$$kWh_{net\ ex\ ante,t} = kWh_{gross\ ex\ ante,t} * NTG_{ex\ ante,t}$$

- **Ex post gross impact estimate.** Ex post gross savings were estimated by incorporating adjustments as necessary including hours of operation and percent of fixtures installed according to the following equation:

$$kWh_{ex\ post,t,r} = (kW_{pre,t} - kW_{post,t}) * \#Fixtures_{adjusted,t,r} * Hours / yr_{adjusted,t,r}$$

where:

$r$  = room technology is located

- **Ex post net impact estimate.** Ex post net savings were estimated by multiplying ex post gross impact estimates by the net-to-gross ratio developed during this study.

$$kWh_{net,t,r} = NTG * (kW_{pre,t} - kW_{post,t}) * \#Fixtures_{adjusted,t,r} * Hours / yr_{adjusted,t,r}$$

Each estimate above was aggregated to the population of participants and annual lifetime savings impacts are provided.

### **Reference to Appropriate IPMVP Option**

For this evaluation, Itron relied on data from lighting time-of-use loggers that were installed under a separate California statewide evaluation. These data provided an unbiased, independent estimate of the operating hours of the lighting fixtures, thereby complying with the spirit of the IPMVP.

The measurement and verification approach proposed for the program was consistent with Option A; it involved verifying at least one of the key assumptions underlying the estimation of savings. The number of measures installed for both compact fluorescent lamps and torchieres was verified through the mail-in survey. In addition, the location of the installed measures was included in the survey. Given the nature of the program, these factors are subject to the most uncertainty. The other determinants of savings—kW/bulb and lifetime—

are reasonably well-established values. While the reasonableness of these parameters was assessed, they were not measured as part of this evaluation.

### **Cost-Effectiveness**

The inputs of the cost-effectiveness calculation that were measured as part of this evaluation are the annual energy and demand impacts, which were adjusted for operating hours and net-to-gross ratio. Other inputs were deemed accurate for the scope of this evaluation. The ex post cost-effectiveness was calculated using the TRC ratio.

$$TRCRatio = \frac{TRC\ Benefits}{TRC\ Costs}$$

where:

$$TRC\ Benefits = ExPostNetImpactEstimate \\ \times PresentValueOfAnnualizedElectricSavingsPerkWh$$

Note that in the *ExPostNetImpactEstimate* developed above, the only values examined were the operating hours and the net-to-gross ratio. The present value of annualized electric savings per kWh and the TRC costs was deemed accurate from the program implementer.

### **Sample Design**

**Participant Sampling Unit.** Since customers received both CFLs and torchieres, the sampling unit was defined to be the participant. Since the torchiere was expected to be the less common measure, the sample was selected from among customers who received that replacement unit. The sample based on torchiere replacements was then supplemented by CFL-only participants to also meet the sample size requirements for CFLs.

In reporting the results on a per-participant basis, use of this sampling plan may require a proportional adjustment based on the overall average number of CFLs turned in per participant. This adjustment will be necessary in the event that the number of CFLs turned in by CFL-only participants differs from that of participants who also turned in torchieres.

### **Survey Design**

Survey preparation is a highly subjective process requiring designers experienced with questionnaires and the topic being researched. While surveys can vary widely in content and design, for this specific project Itron followed an approach similar to the method used designing and testing all survey. This involved the following steps:

- Identifying the research objectives to be addressed by the survey and the specific results that would help meet those objectives,
- Reviewing prior surveys and other information on the same or similar subjects in order to help identify promising questions and questionnaire designs,
- Deciding which issues should be handled through structured (closed-end) questions and unstructured (open-ended) questions,
- Considering the maximum amount of time that the planned respondents are likely to spend on the survey,
- Understanding what classification information is necessary for reporting or analyzing the results, and whether that information is available from other sources or needs to be gathered from the survey.
- Having an experienced survey designer prepare an initial draft of the questionnaire instructions and the survey questions, considering the maximum available survey time,
- Thoroughly trimming questions that appear to be duplicates, unnecessary, or available from other sources,
- Carefully reading over the instructions and questions to identify potential problems such as use of unfamiliar terms, ambiguity, or biased or “loaded” questions,
- Re-reading the questionnaire several times and considering how individuals in each situation might answer the questions,
- Reordering the questions as necessary, considering issues such as proper grouping of subjects, logical flow, and the need to avoid “order bias,” as well as proceeding from general to more specific questions and sensitive questions such as income, which are normally placed at the end of the survey, and
- Asking several others familiar with survey design to complete the survey and provide comments and suggestions, and then incorporating those suggestions.

A copy of the survey instrument is included in Appendix A.

### ***Process Evaluation and Customer Satisfaction***

One of the key objectives of the project was to assess the program delivery system and the resulting customer satisfaction. Program theory was tested by analyzing of answers taken from the participant survey, answers which assess the effectiveness of various program components. The team focused on a number of program features:

- Source of information on the program,
- Reasons for participating in the program,
- Influence of the incentive level on participation,
- Satisfaction with various components of the program,

- Perceived strengths and weaknesses of the program, and
- Suggestions for improving the program.

The results from the participant survey, along with interviews of SDG&E Program Managers, were used to develop a clear picture of whether the program theory was met and there is continuing need for the program. Additionally, other supporting information was integrated into the final analysis, including anecdotal evidence of how participants implement the measures, the effectiveness of the lighting turn-in events, and participation trends.

### **Marketing Materials**

In order to understand and document the marketing process, a review of marketing materials was required. SDG&E's planned marketing activities, as shown in the project planning workbook, are included in Table 2.

**Table 2: Marketing Activities Planned by SDG&E**

| <b>Marketing Activity</b> | <b>Number Through 12/31/2005</b> |
|---------------------------|----------------------------------|
| Local Newspaper Ads       | 40                               |
| Flyers                    | 400,000                          |
| Posters                   | 600                              |
| Direct Mail               | 100,000                          |
| Booths at Local Events    | 20                               |
| Local Radio Ads           | 10                               |

## **4. Results**

As shown in Table 3, the first year of mail-in surveys resulted in 579 returned surveys. Of these, 567 were incorporated in the impact evaluation. The second year of mail-in surveys resulted in 364 returned surveys. Of these, 349 were incorporated in to the impact evaluation. Many responses requiring significant manipulation of the reported data were removed from the impact analysis. These surveys were included in the process evaluation, as the information was deemed valuable.

**Table 3: Surveys Received Per Program Year**

| <b>Program Year</b> | <b>Surveys Returned</b> | <b>Survey Incorporated</b> |
|---------------------|-------------------------|----------------------------|
| Year One            | 579                     | 567                        |
| Year Two            | 364                     | 349                        |
| Overall             | 943                     | 916                        |

The results of this study are divided into an impact evaluation and a process evaluation.

### **Impact Evaluation**

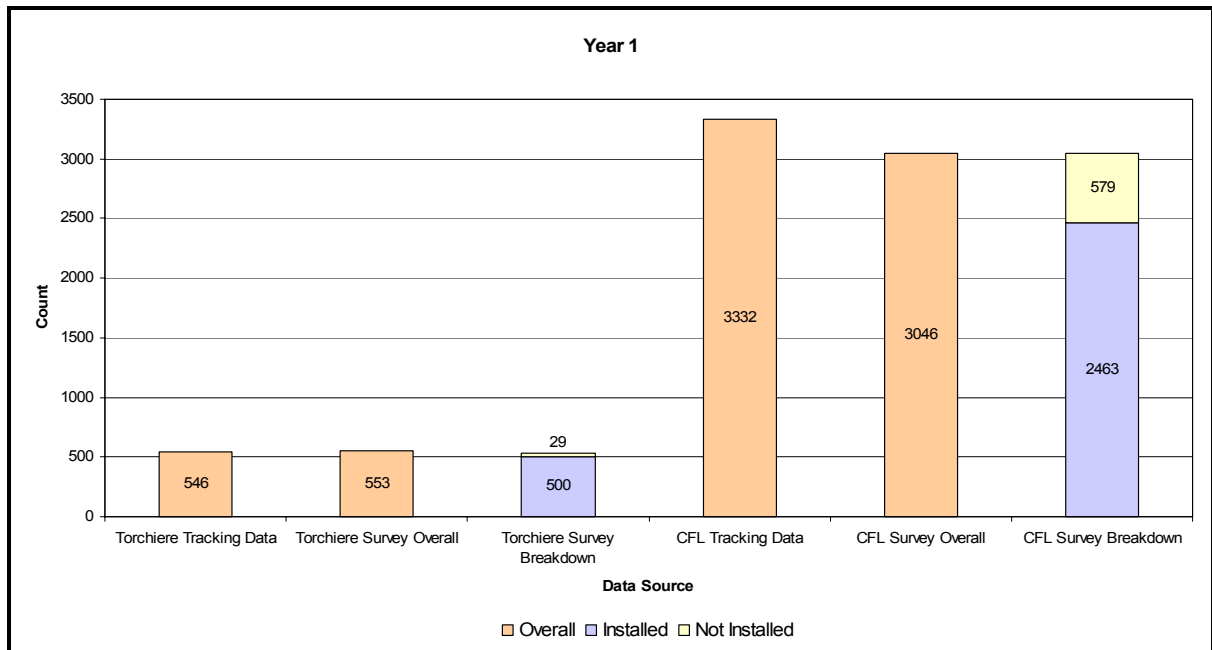
As stated in the work plan, this evaluation follows the spirit of the IPMVP Option A in that the value being verified is the number of lamps installed. In addition, the annual hours of operation were obtained from another independent evaluation in California. Per-lamp kW savings, measure net-to-gross ratio, and measure lifetime are deemed accurate for this evaluation.

Table 4 presents the portion of the survey form used for the impact evaluation analysis. Figure 1, Figure 2, and Figure 3 compare the number of lamps reported in the program tracking system to the number of lamps reported by survey participants by program year. The total number of torchieres/CFLs received by the survey respondents was determined by the response in section two of Table 4. These totals by measure type are respectively represented in Figure 1, Figure 2, and Figure 3 as “Torchiere Survey Overall” and “CFL Survey Overall.” Section three of Table 4 provides a breakdown of the number of torchieres/CFLs installed in various household locations. The numbers of torchieres/CFLs installed are respectively reflected in the figures the “Installed” components of “Torchiere Survey Breakdown” and “CFL Survey Breakdown.” Section four of Table 4 examines the location of torchieres/CFLs that were received but not installed. The numbers of torchieres/CFLs not installed are respectively reflected in Figure 1, Figure 2, and Figure 3 as the “Not Installed” component of “Torchiere Survey Breakdown” and “CFL Survey Breakdown.” Note that in Figure 1, Figure 2, and Figure 3, the Torchiere/CFL Survey Overall number will not equal the Torchiere/CFL Survey Breakdown number because in some cases, the responses from survey participants were inconsistent. A significant effort was undertaken to clean survey responses for mathematical errors. Surveys found to have gross errors were removed from the analysis.

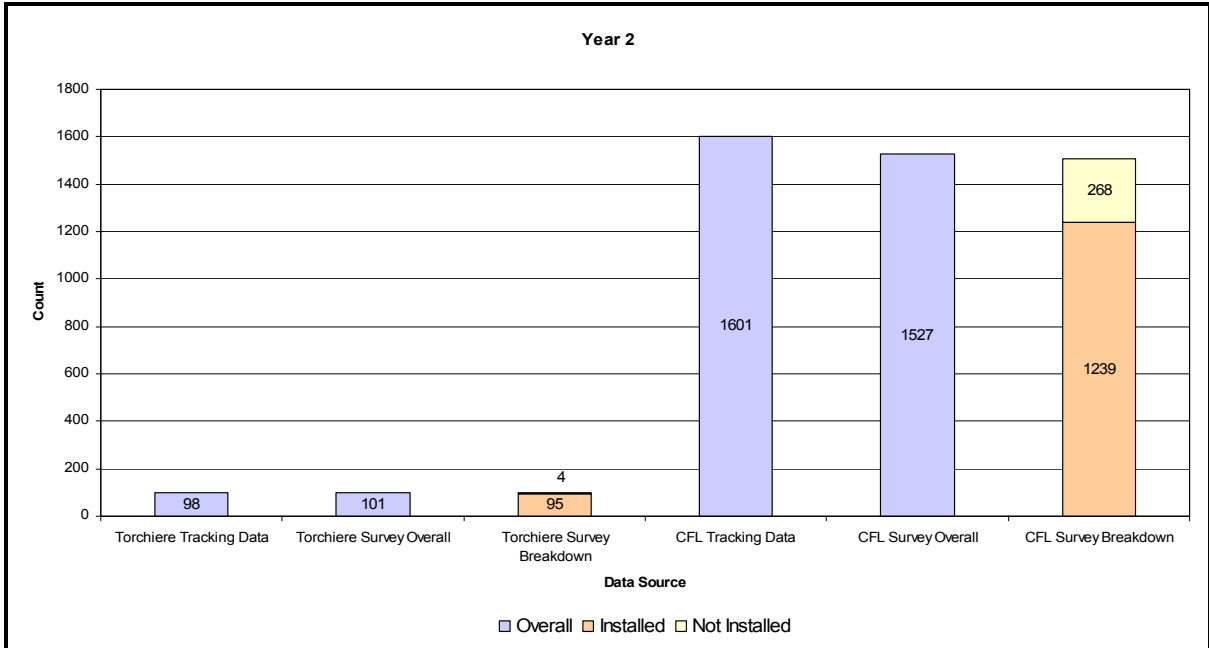
**Table 4: Impact Evaluation Portion of the Survey Form**

|   | Number of CFLs             | Number of Torchieres             |
|---|----------------------------|----------------------------------|
| <b>2. How many CFLs/Torchieres did you receive through the program?</b>                             |                            |                                  |
|   | [CFL Survey Overall]       | [Torchiere Survey Overall]       |
| <b>3. How many of the those CFLs/torchieres were installed in the following areas of your home:</b> |                            |                                  |
| Living Room   | SUM=[CFL Survey Breakdown] | SUM=[Torchiere Survey Breakdown] |
| Kitchen   |                            |                                  |
| Bedrooms  |                            |                                  |
| Closets   |                            |                                  |
| Bathrooms   |                            |                                  |
| Hallways  |                            |                                  |
| Garage  |                            |                                  |
| Outdoors  |                            |                                  |
| Other area (please describe)  |                            |                                  |
| <b>4. How many of the CFLs/torchieres you received from the program were not installed, but:</b>    |                            |                                  |
| 4a. Stored for later use  |                            |                                  |
| 4b. Gave to relative or friend  |                            |                                  |
| 4c. Sold  |                            |                                  |
| 4d. Other (please describe)   |                            |                                  |

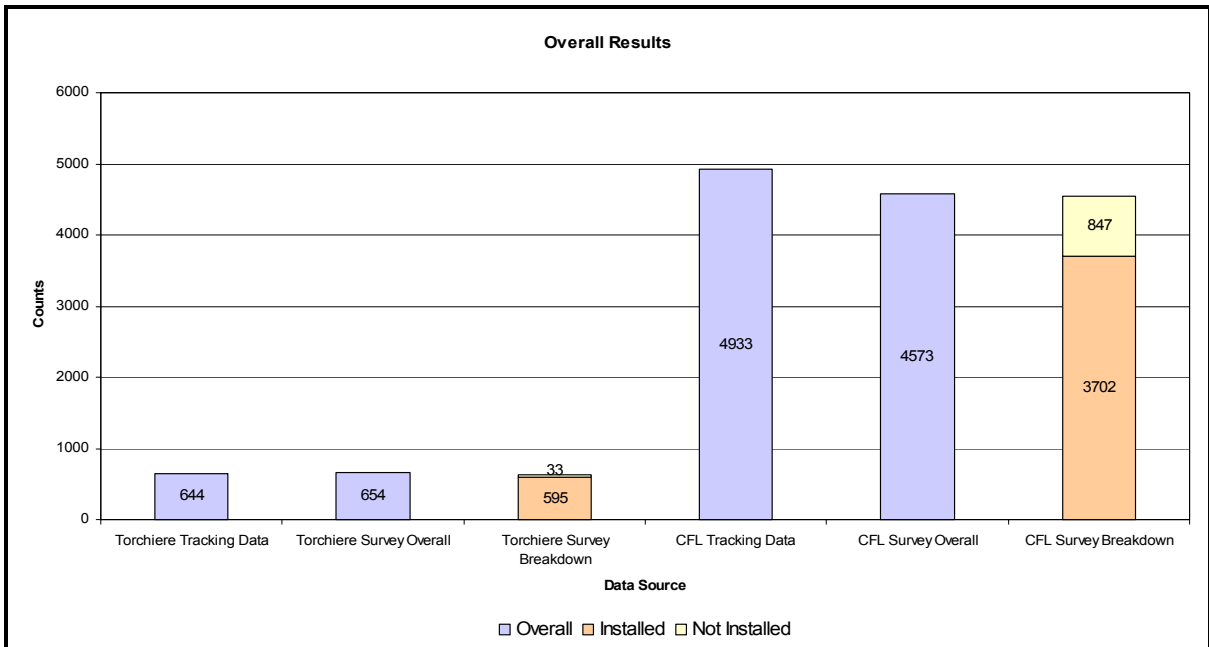
**Figure 1: Year One Lamp Counts by Technology from Tracking System and Survey**



**Figure 2: Year Two Lamp Counts by Technology from Tracking System and Survey**



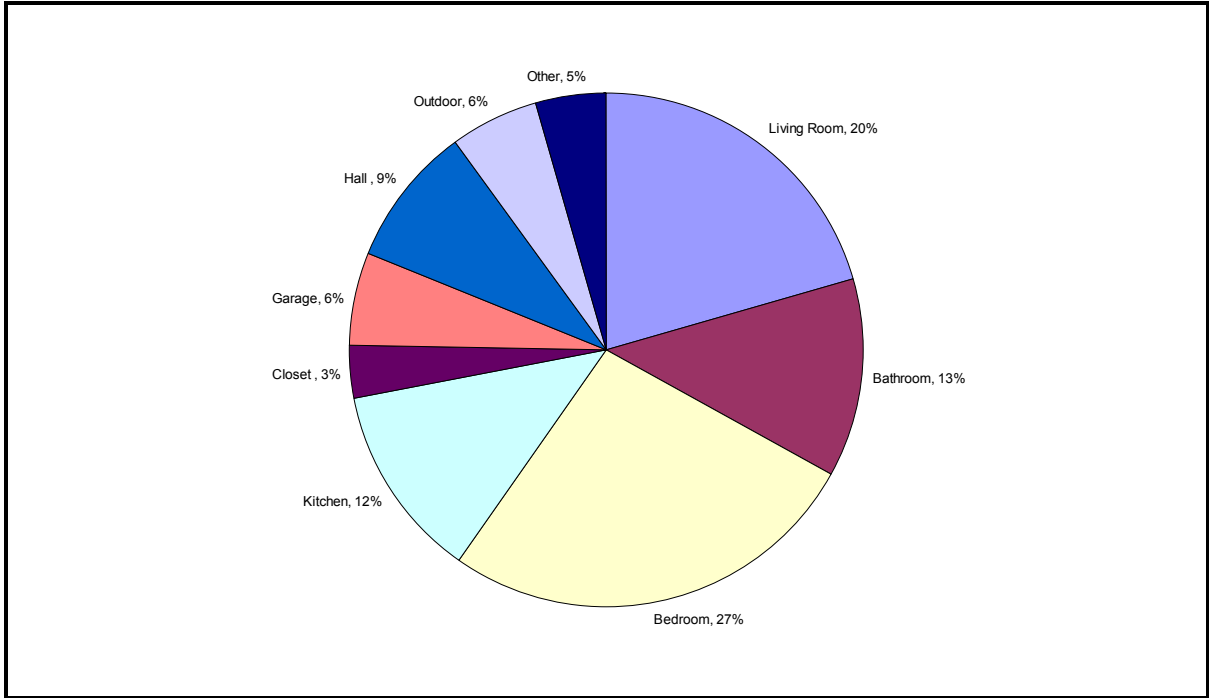
**Figure 3: Overall Lamp Counts by Technology from Tracking System and Survey**



Surveyed participants were asked where they had installed their lamps. Eight of the most common areas were listed, along with a catch-all “other” category for all other locations.

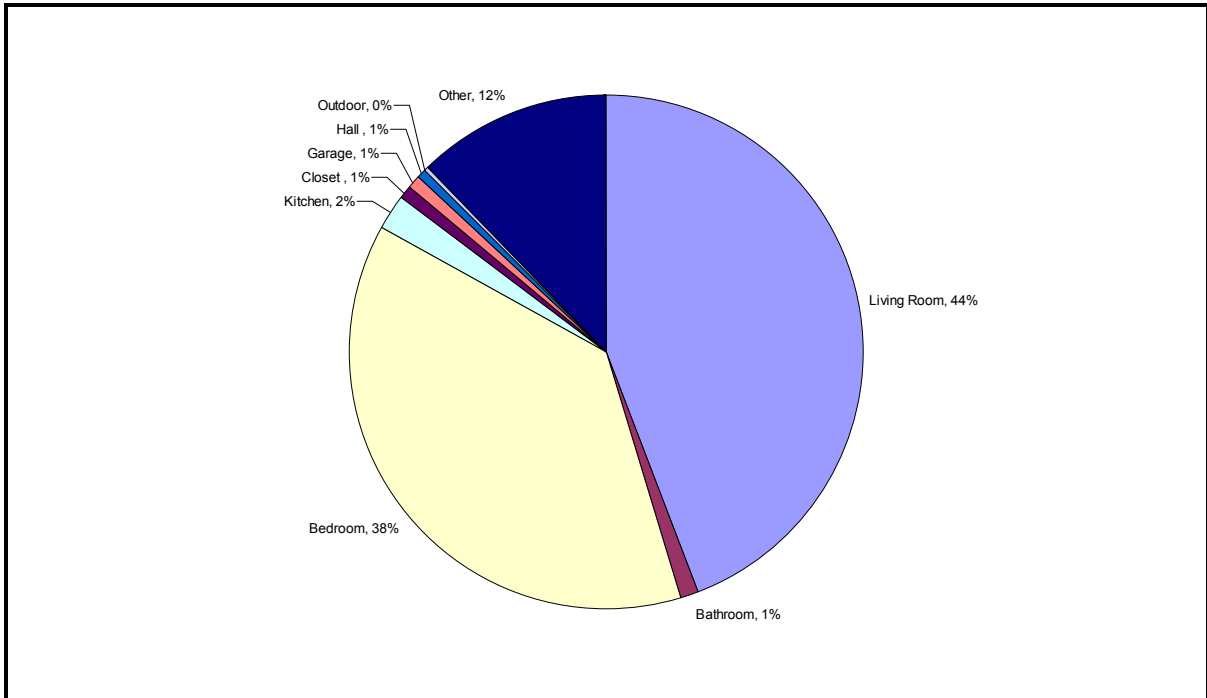
Figure 4 and Figure 5 illustrate the distribution of location for CFLs and torchieres, respectively.

**Figure 4: Location of Installed Compact Fluorescent Lamps in Surveyed Households**





**Figure 5: Location of Installed Torchieres in Surveyed Households**



The other input to the impact analysis that was not stipulated and not included in the survey is the hours of operation, which is a function of the location of the lamp. Operating hours by location were obtained from an independent statewide study,<sup>3</sup> which recently published results from installed data loggers on CFLs. Table 5 presents the annual hours of operation from this report, which will be used for this study. Daily values reported in the study were scaled up to annual values.

<sup>3</sup> KEMA, Inc. *CFL Metering Study Final Report*. Prepared for Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison. Oakland, California. February 25, 2005.

**Table 5: Annual Hours of Operation per CFL**

| Location     | Minimum | Maximum | Average |
|--------------|---------|---------|---------|
| Bedroom      | 0       | 3358    | 584     |
| Bathroom     | 0       | 2153.5  | 547.5   |
| Family Room  | 0       | 3358    | 912.5   |
| Garage       | 73      | 8504.5  | 912.5   |
| Halls/Entry  | 0       | 5694    | 584     |
| Kitchen      | 0       | 4708.5  | 1277.5  |
| Living Room  | 0       | 5949.5  | 1204.5  |
| Laundry Room | 36.5    | 3285    | 438     |
| Other Room   | 0       | 2080.5  | 693.5   |
| Outdoor      | 1131.5  | 1131.5  | 1131.5  |
| Overall      | 0       | 8504.5  | 839.5   |

Torchieres were not monitored in the statewide study. Therefore, Itron relied on other industry research for annual hours of operation. The most applicable value found was the California Baseline Lighting Efficiency Technology Report,<sup>4</sup> which reported a value of 2.31 hours per day (843 hours per year) per fixture. This value is consistent with the CFL hours reported above.

A revised per-bulb annual energy savings was calculated based on the actual distribution of bulbs installed and the hours of operation by room type. Table 6 presents the location-specific survey results, operating hours, and the corresponding demand and annual energy savings. As shown, two different wattage CFL bulbs were distributed via the program. The weighted average value used to calculate program-level results is included at the bottom of the table.

<sup>4</sup> *Lighting Efficiency Technology Report*. Volume 1: California Baseline. California Energy Commission. September 1999.

**Table 6: Location-Specific Annual Energy Savings for CFLs**

| Location                         | Installed Counts |             |       | Annual Hours of Operation | Demand Savings, kW/bulb* |             | Energy Savings, kWh/yr |             |         |
|----------------------------------|------------------|-------------|-------|---------------------------|--------------------------|-------------|------------------------|-------------|---------|
|                                  | 27-Watt CFL      | 23-Watt CFL | Total |                           | 27-Watt CFL              | 23-Watt CFL | 27-Watt CFL            | 23-Watt CFL | Total   |
| Bedroom                          | 110              | 883         | 993   | 584                       | 0.105                    | 0.087       | 6,745                  | 44,692      | 51,437  |
| Bathroom                         | 45               | 418         | 463   | 547.5                     | 0.105                    | 0.087       | 2,587                  | 19,834      | 22,421  |
| Garage                           | 22               | 197         | 219   | 912.5                     | 0.105                    | 0.087       | 2,108                  | 15,579      | 17,687  |
| Halls/Entry                      | 38               | 290         | 328   | 584                       | 0.105                    | 0.087       | 2,330                  | 14,678      | 17,008  |
| Kitchen                          | 63               | 391         | 454   | 1,277.5                   | 0.105                    | 0.087       | 8,451                  | 43,290      | 51,741  |
| Living Room                      | 107              | 651         | 758   | 1,204.5                   | 0.105                    | 0.087       | 13,533                 | 67,958      | 81,490  |
| Laundry Room                     | 15               | 100         | 115   | 438                       | 0.105                    | 0.087       | 690                    | 3,796       | 4,486   |
| Other Room                       | 18               | 149         | 167   | 693.5                     | 0.105                    | 0.087       | 1,311                  | 8,955       | 10,266  |
| Outdoor                          | 29               | 176         | 205   | 1,131.5                   | 0.105                    | 0.087       | 3,445                  | 17,259      | 20,705  |
| Overall                          | 447              | 3,255       | 3,702 | 0                         | 0                        | 0           | 41,199                 | 236,042     | 277,241 |
| Weighted Per Bulb Energy Savings |                  |             |       |                           |                          |             | 92.2                   | 72.5        | 74.9    |

\* Demand savings are non-coincident (Peak Demand Savings/Coincident Diversity Factor).

The next step in the analysis was to adjust the bulbs distributed via the program to the bulbs that were installed and operating. A summary is presented in Table 7. In the “Lamp Counts” columns, there are differences between the number of bulbs received and the number of bulbs installed. This is mostly attributable to participants storing bulbs for future use. Other differences are primarily attributable to minor discrepancies between program tracking database entries and self-reported counts. An error-checking routine was developed to identify and correct common causes of errors. As shown, the number of lamps installed by technology was lower than that claimed by the program.

**Table 7: Installation Rates for Surveyed Participants**

|             | Number Of Bulbs Exchanged Reported In Tracking System | Number Of Bulbs Received Reported In Survey | Number Of Bulbs Installed Reported In Survey | % Installed |
|-------------|---|---|--|-------------|
| Torchiere   | 644   | 654   | 595  | 92.4%       |
| 27W CFL     | 637   | 565   | 447  | 70.2%       |
| 23W CFL     | 4,296   | 4,008                                       | 3,255  | 75.8%       |
| CFL Overall | 4,933   | 4,573                                       | 3,702  | 75.0%       |

This result, along with the revised per-unit energy savings, was applied to the participant population by lamp type to obtain an ex post estimate of program savings. Table 8 illustrates this result.

**Table 8: Overall Energy Savings**

|           | Lamp Counts in Program Tracking System | Ex Post Per Bulb Savings |     | Installation Rate | Gross Ex Post Savings |           | Net to Gross Ratio | Net Ex Post Savings |           |
|-----------|--|--------------------------|-----|-------------------|-----------------------|-----------|--------------------|---------------------|-----------|
|           |  | kW                       | kWh |                   | kW                    | kWh       |                    | kW                  | kWh       |
| Torchiere | 6,297                                  | 0.046                    | 323 | 92%               | 268                   | 1,880,383 | 0.8                | 214                 | 1,504,306 |
| 27W CFL   | 21,388                                 | 0.0126                   | 92  | 70%               | 189                   | 1,383,316 | 0.8                | 151                 | 1,106,653 |
| 23W CFL   | 43,943                                 | 0.0104                   | 73  | 76%               | 346                   | 2,414,427 | 0.8                | 277                 | 1,931,541 |
| Total     | 71,628                                 | N/A                      | 488 | N/A               | 803                   | 5,678,125 | N/A                | 642                 | 4,542,500 |

As shown, the overall net ex post savings from torchieres distributed through the program totaled over 1.5 million kWh. The net ex post savings from CFLs distributed through the program totaled over 3 million kWh. In total, the program’s net ex post savings is 4.54 million kWh, compared to a goal of 5.19 million kWh. The resulting program realization rate is 87.5%, as illustrated in Table 9.

**Table 9: Program Realization Rate**

|                  | Demand Savings, kW | Percent of Goal | Energy Savings, kWh | Percent of Goal |
|------------------|--------------------|-----------------|---------------------|-----------------|
| 2-Yr Goal        | 816                |                 | 5,191,458           |                 |
| SDG&E Claim      | 819                | 100.4%          | 5,230,270           | 100.7%          |
| Verified Ex Ante | 813                | 99.6%           | 5,130,701           | 98.8%           |
| Verified Ex Post | 642                | 78.7%           | 4,542,500           | 87.5%           |

Table 10 presents the energy resulting from the program. Gross program-projected MWh and MW savings represent SDG&E is projected energy and demand savings goals. Net evaluation confirmed program MWh, and MW savings represent the evaluator’s projected savings. Note that there is a significant drop in energy savings after the eighth year, representing the eight-year EUL of CFLs. However, the EUL of the torchieres distributed is 16 years, which explains why all energy savings cease after 16 years. As the program did not report goals by measure, the savings for years 9 through 16 were estimated by applying the ratio of late to early net ex-post savings to the projected savings.

**Table 10: SDG&E Program Energy Impact Reporting for 2004-2005 Programs**

| Year         | Calendar Year    | Gross Program-Projected MWh Savings | Net Evaluation Confirmed Program MWh Savings | Gross Program-Projected Peak MW Savings | Evaluation Projected Peak MW Savings** | Gross Program-Projected Therm Savings | Net Evaluation Confirmed Program Therm Savings |
|--------------|------------------|-------------------------------------|--|---|--|---------------------------------------|--|
| 1            | 2004             | 6,489.32                            | 4,542.50                                     | 0.816                                   | 0.642                                  | –                                     | –  |
| 2            | 2005             | 6,489.32                            | 4,542.50                                     | 0.816                                   | 0.642                                  | –                                     | –  |
| 3            | 2006             | 6,489.32                            | 4,542.50                                     | 0.816                                   | 0.642                                  | –                                     | –  |
| 4            | 2007             | 6,489.32                            | 4,542.50                                     | 0.816                                   | 0.642                                  | –                                     | –  |
| 5            | 2008             | 6,489.32                            | 4,542.50                                     | 0.816                                   | 0.642                                  | –                                     | –  |
| 6            | 2009             | 6,489.32                            | 4,542.50                                     | 0.816                                   | 0.642                                  | –                                     | –  |
| 7            | 2010             | 6,489.32                            | 4,542.50                                     | 0.816                                   | 0.642                                  | –                                     | –  |
| 8            | 2011             | 6,489.32                            | 4,542.50                                     | 0.816                                   | 0.642                                  | –                                     | –  |
| 9            | 2012             | 2,149.02                            | 1,504.31                                     | 0.233                                   | 0.214                                  | –                                     | –  |
| 10           | 2013             | 2,149.02                            | 1,504.31                                     | 0.233                                   | 0.214                                  | –                                     | –  |
| 11           | 2014             | 2,149.02                            | 1,504.31                                     | 0.233                                   | 0.214                                  | –                                     | –  |
| 12           | 2015             | 2,149.02                            | 1,504.31                                     | 0.233                                   | 0.214                                  | –                                     | –  |
| 13           | 2016             | 2,149.02                            | 1,504.31                                     | 0.233                                   | 0.214                                  | –                                     | –  |
| 14           | 2017             | 2,149.02                            | 1,504.31                                     | 0.233                                   | 0.214                                  | –                                     | –  |
| 15           | 2018             | 2,149.02                            | 1,504.31                                     | 0.233                                   | 0.214                                  | –                                     | –  |
| 16           | 2019             | 2,149.02                            | 1,504.31                                     | 0.233                                   | 0.214                                  | –                                     | –  |
| 17           | 2020             | –                                   | –  | –                                       | –                                      | –                                     | –  |
| 18           | 2021             | –                                   | –  | –                                       | –                                      | –                                     | –  |
| 19           | 2022             | –                                   | –  | –                                       | –                                      | –                                     | –  |
| 20           | 2023             | –                                   | –  | –                                       | –                                      | –                                     | –  |
| <b>TOTAL</b> | <b>2004-2023</b> | 69,106.75                           | 48,374.45                                    | 0.816                                   | 0.642                                  | –                                     | –  |

***Process Evaluation***

The respondents were asked a series of questions regarding their experiences with the program in general, and specifically their experiences at the turn-in location.

***Event Attendance***

The survey participants attended 66 different turn-in events. Nearly 8% reported receiving bulbs at Kearny High School, which garnered the highest percentage, followed by Grant Middle School in the City of Escondido and the South Chula Vista Branch Library.

The average time spent waiting in line for all events was almost 10 minutes; however, the median wait time cited was five minutes, suggesting that most of participants experienced short wait times. A few participants reported wait times of one hour or more.

**Program Awareness**

Of those who reported how they first learned of program, the most commonly cited source was a direct mailing at over 34%, followed by SDG&E bill inserts with approximately one-fourth of the respondents.

**Table 11: How Did You First Hear of the SDG&E HTR Turn-In Program?**

|                     | Percentage | Frequency |
|---------------------|------------|-----------|
| Direct Mailing      | 33.8%      | 297       |
| Bill Insert         | 24.7%      | 217       |
| Print Advertisement | 13.8%      | 121       |
| Other               | 9.8%       | 86        |
| Word of Mouth       | 9.2%       | 81        |
| Other SDG&E Program | 5.1%       | 45        |
| Radio Advertisement | 3.6%       | 32        |

**Participation Satisfaction**

When asked to rate the relative ease of participation using a Likert scale, where 1 represents “very easy” and 10 represents “very difficult”, 58% rated the program a 1, or very easy, and an additional 14% gave the program a rating of 2. Only slightly over 5% of participants rated the program as “very difficult.”

In fact, when asked what they liked most about the program, the most commonly mentioned aspect was the ease of participation, with 235 participants citing the simplicity as the most favorable aspect. Another well-liked aspect was that the program was free. Becoming more energy efficient was also often cited, along with the prospect of saving money on future energy bills.

When asked what they liked least about their experience with the program, the most common complaint was waiting time, cited by 18% of the respondents. An inconvenient location and the unavailability of parking were also frequently cited. Thirty-eight participants stated that there was a shortage of lamps at their location. In addition, 72 respondents, when asked what they liked least, replied “nothing.”

Asked to rate their overall satisfaction with the program on a scale from 1 to 10, with 1 indicating “very dissatisfied” and 10 indicating “very satisfied,” over 80% of respondents

rated the program an 8 or above, and just over 50% gave the program a 10. Only 7% gave the program a 1, indicating that they were very dissatisfied.

### **Increased Awareness**

When asked how their participation in the program affected their awareness of energy efficiency, slightly over half indicated that their awareness increased “significantly” and an additional 42% said their awareness increased “somewhat.” Only 5% of participants indicated that the program did not increase their awareness at all.

The participants were asked how their experience with the CFLs and torchieres influenced whether they would continue to install CFLs and torchieres in the future. Seventy-six percent of participants indicated that they would install CFLs again when the units burned out, and 47% affirmed that they would install torchieres again. Furthermore, 64% responded that they would buy additional CFLs for other lamp fixtures in their house.

### **Suggestion for Improvement**

The respondents were asked to make suggestions for improving the program. The most frequently given response was that the program was great and SDG&E should “keep it up.” Many respondents requested that SDG&E hold more events at more locations, thus making it more convenient, and several requested that the program be changed so that they are not required to turn in their old lamps and incandescent light bulbs. Also often mentioned was increasing the number of torchiere styles available in order to allow participants to coordinate with their existing home décor. A number of participants felt that the program needed better advertising.

## **4.1 Cost-Effectiveness**

The inputs to the cost-effectiveness calculation measured as part of this evaluation were annual energy and demand impact, which were adjusted for operating hours and net-to-gross ratio. Other inputs were deemed accurate for the scope of this evaluation. The ex post cost-effectiveness was calculated using the TRC ratio.

$$TRCRatio = \frac{TRC\ Benefits}{TRC\ Costs}$$

where:

$$TRC\ Benefits = ExPostNetImpactEstimate \\ \times PresentValueOfAnnualizedElectricSavingsPerkWh$$

The ex post net impact estimate was developed as above. The only values examined were the operating hours and the number of units of each measure installed. The present value of annualized electric savings per kWh and the TRC costs were deemed accurate from the program implementer. The evaluation used the program workbooks published on SDG&E's website ([http://www.sdge.com/regulatory/ee\\_reports\\_sep05.shtml](http://www.sdge.com/regulatory/ee_reports_sep05.shtml)). As stated earlier, the program did not report goals by measure. Therefore, an estimate was calculated for the number of each measure that would closely match the program savings goal and the direct implementation cost. The program had a resulting TRC ratio of 1.79 compared to a projected TRC ratio of 1.66, indicating that the program is more cost-effective than estimated.



# Appendix A: Survey Instrument

## SDG&E Hard-to-Reach Lighting Turn-In Program

Date \_\_\_\_\_

Please take the next few minutes to complete this confidential survey regarding the SDG&E Hard-to-Reach Residential Lighting Turn-In Program. **By returning a completed survey form you will be entered into a random drawing for one of eight \$25 gift certificates to the major home improvement store of your choice.** The Program allows consumers to exchange inefficient bulbs or halogen torchiere fixtures (lamps) for free energy-efficient compact fluorescent bulbs (CFL bulbs) or fluorescent torchiere fixtures (lamps). The purpose of this survey is to obtain your views on the Program based on your experience to date. Your answers will be kept completely confidential and your name and address will not be published or given to any other party. Thank you for taking the time to provide us with this feedback.

### General Program Questions

1. At what event /where did you receive your light bulbs? \_\_\_\_\_
  - 1a. How long did you wait in line to exchange your light bulbs and/or torchieres? \_\_\_\_\_

|   | Number of CFLs            | Number of Torchieres          |
|---|---------------------------|-------------------------------|
| <b>2. How many CFLs/Torchieres did you receive through the program?</b>   |                           |                               |
|   | CFLs                      | Torchieres                    |
| <b>3. How many of the those CFLs/torchieres were installed in the following areas of your home:</b>                                 |                           |                               |
| Living Room   |                           |                               |
| Kitchen   |                           |                               |
| Bedrooms  |                           |                               |
| Closets   |                           |                               |
| Bathrooms   |                           |                               |
| Hallways  |                           |                               |
| Garage  |                           |                               |
| Outdoors  |                           |                               |
| Other area (please describe)  |                           |                               |
| <b>4. How many of the CFLs/torchieres you received from the program were not installed, but:</b>                                    |                           |                               |
| 4a. Stored for later use  |                           |                               |
| 4b. Gave to relative or friend  |                           |                               |
| 4c. Sold  |                           |                               |
| 4d. Other (please describe)   |                           |                               |
| <b>5. Of those CFLs/torchieres from the program that you installed,</b>   |                           |                               |
| 5a. How many were replaced or removed?  | Replaced    Removed       | Replaced    Removed           |
| 5b. How many of the free CFLs/torchieres were replaced/removed due to the following reasons?  | __ Burned out/Broke       | __ Burned out/Broke           |
|   | __ Disliked Light Quality | __ Disliked Light Quality     |
|   | __ Removed Lamp           | __ Removed Lamp               |
|   | __ Other                  | __ Other                      |
| 5c. If any of the free CFLs/torchieres were installed and then replaced, how many of each of the following were they replaced with: | __ Other CFLs             | __ New CFL torchiere          |
|   | __ Incandescent Bulbs     | __ New halogen torchiere      |
|   | __ Nothing, Lamp Removed  | __ New incandescent torchiere |
|   |                           | __ Other lamp                 |
|   |                           | __ Nothing, Lamp Removed      |

