2005/06 PRESCRIPTIVE
COMMERCIAL LIGHTING EFFICIENCY
PROGRAM EVALUATION

Final Report

March 2006

Prepared under Contract with:

Sacramento Municipal Utility District (SMUD)

Prepared by:

ADM Associates, Inc.
3239 Ramos Circle
Sacramento, CA 95827
916-363-8383

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

This program evaluation report provides an analysis of the impacts and customer satisfaction levels of the Prescriptive Commercial Lighting Efficiency Program that Sacramento Municipal Utility District (SMUD) is offering to commercial customers in its service territories. The purpose of the Commercial Lighting Program was to assist customers in making energy efficiency lighting replacements or improvements to their facilities. The impact evaluation covered program participants for the 2005/06 program year.

The overall objective for the evaluation of the Prescriptive Commercial Lighting Efficiency Program was to determine the net energy savings, the demand impacts resulting from the program and the level of customer satisfaction with the program. Net savings represent the impacts of the lighting energy efficiency measures attributable to the Commercial Lighting Program that were not the result of free-ridership. Free-ridership is defined as occurring when a participant would have installed the same energy measure in the absence of the program. Because the energy savings realized by free-ridership are not induced by the program, these savings should not be included in the estimates of the program's actual impacts.

Tables ES-1 (kWh) and ES-2 (kW) summarize the results of the evaluation effort. Peak demand is defined as demand between 1 and 9 PM weekdays. The data reported in these tables provide an overall comparison between the estimates of program-level net energy savings developed in this study and expected savings for the Commercial Lighting Program as reported in tracking system records up to the time of report preparation. Note that the program is still ongoing for the program year until all available funds for the program are exhausted.

Table ES-1. Summary of Energy Savings By Program Calendar Year

Project Year	*No of Projects*	*Expected Gross kWh Savings*	*Verified Gross kWh Savings*	*Realization Rate*	*Free ridership rate*	*Net kWh Savings Verified*
2005	318	7,256,815	4,996,102	68.8%	4.3%	4,779,757
2006 (ongoing)	58	2,352,470	1,814,855	77.1%	4.3%	1,736,267
Combined	376	9,609,285	6,810,957	70.9%	4.3%	6,516,023

Table ES-2. Summary of Peak Demand Reductions By Program Calendar Year

Project Year	*No of Projects*	*Expected Gross kW Savings*	*Verified Gross kW Savings*	*Realization Rate*	*Free ridership rate*	*Net kW Savings Verified*
2005	318	1,455	907	62.3%	4.9%	866
2006 (ongoing)	58	446	322	72.0%	4.9%	312
Combined	376	1,902	1,228	64.6%	4.9%	1,179

1. INTRODUCTION

Under contract with Sacramento Municipal Utility District (SMUD), ADM Associates, Inc. (ADM) has performed an evaluation of the Prescriptive Commercial Lighting Efficiency Program that SMUD is offering to small commercial customers in its service territories. The evaluation was intended to improve and/or refine the net program energy savings and demand reduction estimates for the program for calendar year 2005/06 and gauge the level of customer satisfaction with this program.

1.1 DESCRIPTION OF PROGRAM

The Prescriptive Commercial Lighting Efficiency Program is a contractor driven program designed to reach commercial customers with loads of 150 kW and lower. In this program, lighting contractors are approaching the customers directly to offer incentives to replace the old lighting systems with energy efficiency lighting systems.

This program was first offered in summer of 2001 funded by SB5X grant contract with the California Energy Commission and was discontinued in August of 2002, and reopened again in 2003 and 2004 following full subscription of funding for each year. Originally, this initiative sought to obtain immediate peak load reduction and energy savings in the hard-to-reach small commercial sector through the replacement of old lighting systems with energy efficiency lighting fixtures and lamps. The incentives from this initiative were designed to cover a significant portion of the cost of the lighting equipment installed and were paid directly to the lighting contractors, who provided the primary mechanism for marketing and implementation of the initiative. Eligible technologies include T-8 lamps and electronic ballasts, delamping, compact fluorescent lamps, LED exist signs and occupancy sensors.

As the contractors are responsible for all aspects of customer recruitment, including who and what type of commercial establishments to recruit, there is a disproportionate number of worship centers among all program participants that have been recruited by a small number of participating contractors. Of all program participants, worship centers account for 87 out of 376 participants (or 23%) in the program year 2005/06. Worship centers are known to have occupancy patterns that are distinctly different from all other commercial establishments. Due to the high number of worship centers in the pool of program participants, the analysis of the program savings is broken down into two categories: worship centers and non-worship centers, and the results are presented accordingly.

Table 1-1 shows the distribution of expected energy savings and peak demand reduction by the category of establishments. Note that peak demand reduction is defined as the average reduction in demand for electricity between 1 PM and 9 PM weekdays.

Table 1-1. Distribution of Commercial Lighting Projects and Savings by Service Territory and Program Component

Type of Establishment	*Number of Projects*	*Expected Annual Savings (kWh)*	*Expected Peak Demand Reduction (kW)*
Worship	87	2,352,385	521
Non Worship	289	7,256,900	1,381
Total	376	9,609,285	1,902

1.2 OVERVIEW OF APPROACH

The overall objective for the evaluation of the Prescriptive Commercial Lighting Program was to determine the net annualized energy savings and coincident/non-coincident demand impacts resulting from participation in the program during 2005/06.

A schematic overview of the approach used for the evaluation is provided in Figure 1-1. The approach had the following main features.

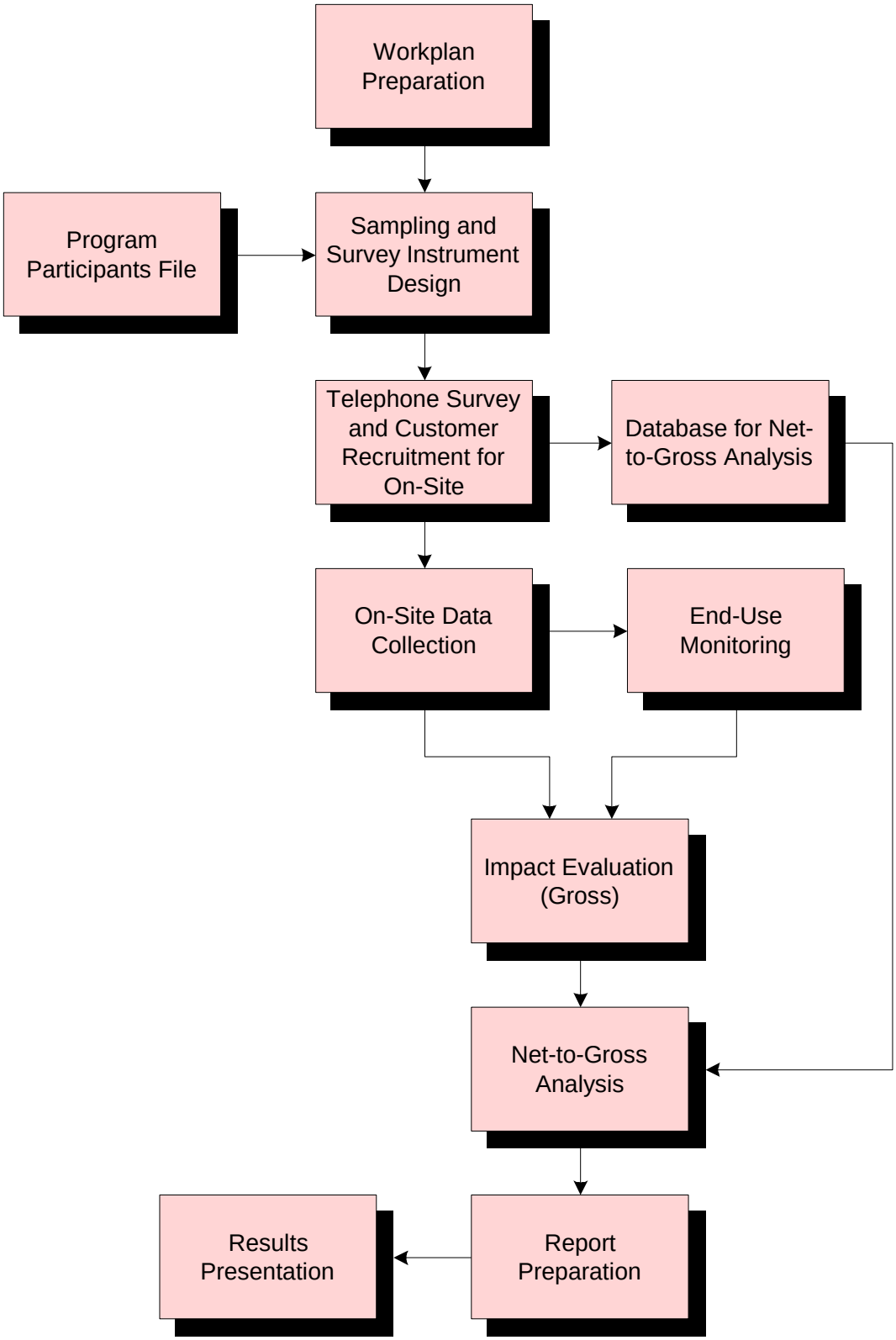

Figure 1-1. Overview of Evaluation Approach

- Data for the study have been collected through review of program documentation, on-site inspection, metering, power measurements and interviews with customers. Based on data provided by SMUD, sample designs were developed for on-site data collection for the impact evaluation and for the telephone survey to collect decision-making information for the net-to-gross analysis that would provide savings estimates for the Commercial Lighting Program with ±10% precision at the 95% confidence level.
- Onsite visits prior to the installation of the lighting equipment were made to 125 participating establishments. During this initial visit, we collected data pertaining to the quantity of all possible lighting upgrade that can potentially be rebated through this program, performed measurements of light levels in areas to be delamped, and performed clamp-on power measurements on some lighting circuits where the lighting equipment was to be replaced.
- After the installation of the new lighting equipment was completed, we returned to the facility to collect data on the quantity of the lighting equipment actually replaced, performed measurements of light levels in delamped areas and performed clamp-on power measurements on the same lighting circuits where the initial measurements were taken. We also left lighting loggers to monitor the operation of the affected lighting. The lighting loggers were left at the facility for a minimum of two weeks. We successfully made the second visit to 102 participating establishments. (installation at the rest of the sites was not completed by the time of final report preparation).
- A telephone survey was administered to program participants to learn about their decision-making process and how the availability of funds from SMUD's program affected their decision to upgrade their lighting to high efficiency lighting. This survey was also designed to gauge the level of satisfaction among the program participants. A total of 76 participants responded to our request for interview.

1.3 ORGANIZATION OF REPORT

This report on the evaluation of the Commercial Lighting Program is organized as follows.

- Chapter 2 discusses the collection and preparation of the data used for the evaluation effort.
- Chapter 3 presents and discusses the methods used for and the results obtained from estimating gross savings for measures installed under the Commercial Lighting Program.
- Chapter 4 presents and discusses the methods used for and results obtained from estimating net savings for the Commercial Lighting Program.

- Chapter 5 discusses lessons learned about the Commercial Lighting Program.
- Chapter 6 summarizes the results of the study.
- Appendix A is a listing of the sites selected for the on-site data collection sample.
- Appendix B provides a copy of the form used as the instrument for the on-site data collection.
- Appendix C provides a copy of the questionnaire used as the instrument for the telephone survey.

2. DATA COLLECTION AND PREPARATION

The evaluation of the Commercial Lighting Program was based on an extensive body of data collected in various ways: through review of program documentation, through on-site data collection, through monitoring, and through telephone surveying. The collection and preparation of the data used for the evaluation are described in this chapter.

2.1 REVIEW OF PROGRAM DOCUMENTATION

The first step in the evaluation effort was to review the documentation for participants in the Commercial Lighting Program. Program materials that were relevant to the evaluation effort that were examined included program forms and databases.

The documentation submitted by the contractor to SMUD was reviewed to determine the quantities of light fixtures to be replaced and the contact information for the participant. Information about the savings calculation methodology, including (1) what methodology was used, (2) specifications of assumptions and sources for these specifications, and (3) correctness of calculations was also reviewed. Based on the contact information provided by the contractor, the contact person at the selected sites was called to set up onsite data collection.

2.2 SAMPLING PLAN FOR ON-SITE DATA COLLECTION

Data that could be used for estimating the gross and net savings being achieved through the program was collected for samples of projects for which SMUD paid incentives through the Commercial Lighting Program. Determining the appropriate samples of projects was an important part of preparing the project work plan. The broad outline of our sampling plan is presented here. A refined sampling plan was prepared during the project using the tracking system data that SMUD has on the participants in its Commercial Lighting Program. As the following discussion demonstrates, there was a variety of considerations that entered into the preparation of the sampling plan, and arriving at the final sampling plan was therefore an iterative process. We determined several alternatives for the sampling plan and provided these alternatives to SMUD staff for review. Based upon the staff's review comments, we developed the final version of the sampling plan.

The work on this project was intended to produce two estimates of gross lighting savings for each sample site: an expected gross savings estimate (as reported in

the program tracking system) and the verified gross savings estimates developed through the evaluation procedures. Program-level gross savings for the Commercial Lighting Program were developed by applying achieved savings rates to the program-level expected savings. This procedure for estimating gross savings for the program is an application of ratio estimation, which improves the precision of the estimates. The ratio estimate of program-level savings is given by the following formulation:

$$\hat{Y}_R = \frac{y}{x}X = \frac{X}{x}y$$

where Y_R is the estimate for program-level gross savings, y is the sample total for gross savings, x is the sample total for the auxiliary variable, and X is the population total for the auxiliary variable. For this ratio estimation of program-level savings, estimates of expected savings from the program tracking records were used as the auxiliary information.

When ratio estimation is used, the sample size required to estimate the ratio with an error bound B with probability 1 - α can be determined from the following formula:

$$n \approx \frac{N s_{y-rx}^2}{ND + s_{y-rx}^2},$$

where N is the number of sites in the population,

$$D = \frac{B^2 \bar{x}^2}{z_{\alpha/2}^2}.$$

and

$$s_{y-rx}^2 = s_y^2 + r^2 s_x^2 - 2r\hat{\rho} s_x s_y$$

Thus, to determine n we need estimates of $\bar{x}$, s_y, s_x, r and ρ.

The initial estimation for the Commercial Lighting Program was that it would produce 8.1 GWh of savings from 1,500 projects. This implies that $\bar{x} \cong$ 5,400 kWh. Estimates of s_y and s_x can be derived by making assumptions regarding the coefficients of variation for x and y.

Estimates of r and ρ are provided from previous evaluations of lighting savings that we have previously conducted. For example, Figure 3-1 provides a summary comparison between the verified savings and expected savings for a sample of

sites with lighting efficiency measures. For this example, r = 1.047 and ρ = .92 (i.e., an R^2 of 0.84).

Using these assumptions, we calculated estimates of the sample sizes required to estimate the achieved savings realization rate with 10% precision at 95% confidence. The sample size estimates for difference coefficients of variation are shown in Table 3-1. (Because x and y are highly correlated, the same coefficient of variation can be applied for both.)

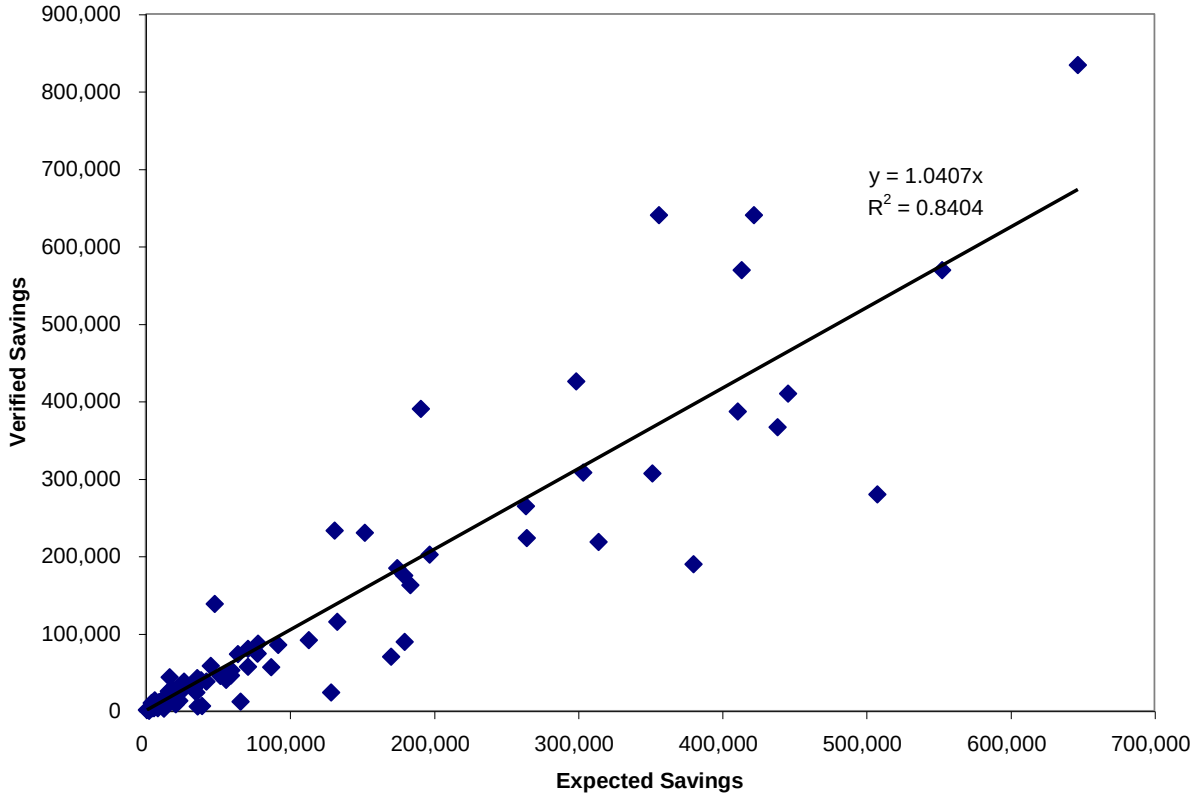

Figure 2-1 Comparison of Verified Lighting Savings to Expected Lighting Savings for Sample of Sites with Lighting Efficiency Measures

Table 2-1 Estimates of Sample Sizes Required to Estimate Realization Rate for Different Coefficients of Variation for x and y

Coefficient of Variation	*Estimated Sample Size*
3.00	541
2.00	360
1.00	180
0.75	135
0.50	90
0.25	45

As Table 3-1 shows, the greater the degree of variability in the savings values (as indicated by higher coefficients of variation), the greater the required sample size. Our experience in evaluating savings from lighting projects for other utility programs is that the coefficients of variation are generally high because the distributions of savings are generally positively skewed. Moreover, it is often the case that a relatively small number of projects account for a high percentage of the estimated savings for a measure.

However, the sample design we used for selecting projects for the sample takes such skewness into account. To accomplish the sampling, we used an approach suggested by Hidiroglou[1], which we have used for other evaluation studies. With this approach, a number of sites with large savings was selected for the sample with certainty, and a random sample was taken of the remaining sites. To further improve the precision, non-certainty sites were selected for the sample through systematic random sampling. That is, a random sample of sites remaining after the certainty sites had been selected was selected by ordering them according to the magnitude of their savings and using systematic random sampling. Sampling systematically from a list that was ordered according to the magnitude of savings ensured that any sample selected would have some units with high savings, some with moderate savings, and some with low savings. Samples could not result that had concentrations of sites with atypically high savings or atypically low savings.

Using this procedure essentially reduced the coefficient of variation for the non-certainty sites that were sampled. For working purposes we assumed that a coefficient of variation of 0.5 to 0.75 could be achieved by applying this approach, which was consistent with our past experience. Accordingly, we selected a sample size of 125 sites for the on-site data collection and analysis in this project.

2.3 ON-SITE DATA COLLECTION AND MONITORING PROCEDURES

We collected primary data on the facilities of the customers selected for the study sample through on-site visits. We visited each sample site twice, once to collect pre-installation data and again to collect post-installation data. At the post-installation visit, we performed monitoring with time-of-use loggers to obtain data for assessing hours of lighting operation and take lighting level measurements to ensure IESNA standards are being complied with.

The steps in our process for conducting the on-site evaluation work are as follows:

[1] See Hidiroglou, M. A., "The Construction of a Self-Representing Stratum of Large Units in Survey Design," **The American Statistician**, February 1986, Vol. 40, pp. 27-31.

- Identify the potential candidates for onsite data collection;
- Call customers to recruit for evaluation measurements;
- Schedule pre-installation measurement visits;
- Make first site visits to collect data on pre-installation lighting equipment;
- Notify contractors on completion of first site visits;
- Make post-installation measurement visits to verify equipment installation and lighting levels, to install lighting loggers, and to administer customer satisfaction questionnaire;
- Return to site to remove loggers;

To recruit sites for the evaluation effort, we worked with SMUD staff and the program's lighting contractors. We requested that the contractors provide us with daily or weekly a list of customers who were scheduled for installation of new lighting equipment through the commercial lighting program. We contacted these businesses immediately to introduce the evaluation effort. Businesses who had not received their new lighting became potential participants in the evaluation effort. Interested businesses were screened to ensure that they fit within the sampling criteria specified in the sampling design.

A member of our field staff made a pre-installation visit to each site selected for the sample to collect data on the characteristics of the lighting equipment being replaced. This visit was made to verify what equipment a lighting contractor is actually replacing. Our staff member also made note of any fixtures to be replaced with the lamps already burned out or non-functional. Lighting level measurements in areas that were going to be delamped were taken using handheld lighting meter. This visit ensured that accurate baseline data were available on which to base the calculations of lighting savings and verification of adequate lighting levels after retrofitting.

After the contractor had installed the new lighting equipment at a site selected for the sample, we returned to the site to perform post-installation data collection. During this post-installation visit, our field staff accomplished several tasks. First, they verified that the measures that were rebated were indeed installed, that they were installed correctly, and that they functioned properly. Second, they collected the data needed to analyze the energy savings that had been realized from the installed measures. Third, they administered the decision-makers survey instrument. During this post-installation visit, the field staff also performed monitoring with time-of-use logger to obtain data for assessing hours of lighting operation and take lighting level measurements to ensure IESNA standards were being complied with. Additionally, clamp-on power measurements were also performed on lighting circuits where pre-measurements were done.

To verify that measures had been installed and that the installation had been done correctly, our field staff checked and verified the installation of light bulbs, ballasts, reflectors, and controls. This was performed through opening up the light fixtures to view the lamps and ballasts installed. For control measures, we checked for proper installation and enumerate the type and number of control points installed.

After the on-site data were entered into our internal database, they went through several stages of error-checking to detect errors that might have been introduced through the data entry process, to detect errors and/or inconsistencies that may exist within the data for a given facility, and to detect any internal inconsistencies within the database. This in-house data reduction and error checking effort ensured that the data collected are of high quality, internally consistent and sufficiently complete to allow analysis of end-use energy use and savings for the facilities.

Some important items of data needed for the analysis of gross savings (primarily the operating hours and peak hours utilization of the lighting equipment) were collected through monitoring at the sites selected for the on-site data collection. We used the monitoring to obtain information on operating hours and other important factors for lighting measures.

We monitored the post-retrofit hours of operation as the basis for calculating lighting efficiency savings. For this monitoring of lighting operating hours, we used Time-of-Use (TOU) data loggers manufactured by Pacific Science and Technology. The TOU loggers provided a time profile of on-off usage, and therefore allowed the calculation of kWh usage according to peak/off-peak periods. (In practice, the loggers sense when a fixture is on by detecting the light emitted from a fixture when it is operating.)

For each facility with multiple lighting efficiency measures that was selected for monitoring, we developed a plan for monitoring a sample of "last points of control" for retrofitted fixtures in different types of usage areas to determine average operating hours of such fixtures. The degree of homogeneity among fixtures within a defined usage area was very high due to the size of the establishment, thus requiring that only a few fixtures be monitored to determine hours of operation. In areas with distinctly different operating hours within the same building, we performed monitoring on fixtures located in the different areas and took a normalized average of the operating hours based on the quantity fixtures to be replaced in each area.

Our general procedure for the installation of the loggers was to find a representative lighting fixture, place a lighting logger in the fixture, write down logger serial number, location, fixture type and specifications, and the number of

fixtures represented by the fixture monitored. The representative lighting fixture was chosen on the basis of fixture type and expected time of use patterns. Before the installation of the lighting loggers, a clamp-on measurement of the fixture load for the lighting circuit was made and recorded. The type and number of lighting fixtures connected in the circuit was also recorded.

The considerations addressed in the installation of the lighting loggers included the following:

- Open up fixture and record lamp and ballast specifications.
- Adjust lighting level threshold on lighting logger by holding it 18 inches from the lamps. Using a small flat screwdriver, slowly adjust so lighting logger just turns on at that lighting level. Press the reset button on the logger.
- Place lighting logger in fixture. While loggers can be placed in many fixtures using the magnetic strip on the logger, double-side tape may need to be used with other types of fixtures to hold the logger in the fixture. Care is taken with reflective fixtures not to diminish the reflective qualities. Many fixtures have lens covers that need to be opened up to place the loggers; for such fixtures, the loggers are placed so that the light sensor is looking at the lamp.
- Record the serial number of the logger, the date and time, the site and location in the building. Draw a sketch of the facility and identify the fixture location clearly enough so someone else can find it.
- Place a colored sticker on the outside of the fixture so it can be identified as someone walks up to it.

In addition to installing the loggers, our field staff also performed lighting level measurements in areas to be delamped before and after the installation to verify that each site is meeting the minimum lighting requirements as set by IESNA. The field staff recorded this information to verify that contactors are meeting this requirement. Light meter readings were taken to measure lighting intensity (in lumens) for two cases:

- All lights off, where daylighting is available with no controls;
- All lights on, using both first and second levels.

In usage areas with bi-level switching, the light meter readings were taken for four cases:

- All lights off, where daylighting is available with no controls;
- Lights on, using first level only;
- Lights on, using second level only; and
- All lights on, using both first and second levels.

Measurement of the lighting levels in any given area, for any of the above cases, followed the procedures below:

- First, the working light level (height from the floor) was determined based on the type of floor area use. For instance, in an office situation the lighting shoud be measured at 3 feet from the floor. In a clothing store, where the floor has clothing racks, this level would be measured at 5 feed from the floor.
- The space was divided into a grid of equal areas. The number of grids could be 4 or 9, depending on the distribution of lighting fixtures.
- The lighting levels were measured at the center of each of the grids. The average of the measurements was designated as the lighting level.

Each logger was left onsite to collect data for an average of two weeks of operation. These data were extracted from the loggers at the end of the monitoring period through one last on-site visit.

2.4 TELEPHONE SURVEY PROCEDURES

The information needed to perform the net-to-gross and customer satisfaction analysis was collected through a telephone survey. All participants selected for onsite visits were contacted in the telephone survey.

In the telephone interviews, data were collected that pertained to customers' decision-making criteria and their attitudes and behavior. Essentially, the customers were questioned regarding their knowledge of SMUD's programs, their level of interest in the programs, their reasons for participating, and the measure implementation decisions they would have made had they not participated in the Commercial Lighting Program.

A copy of the questionnaire that was the instrument for the telephone survey is provided in Appendix C. The questionnaire had questions that were designed to gather the following types of information:

- Type of ownership and organization
- How energy decisions were made
- How difficult it was to meet program energy standards
- How much influence the Commercial Lighting Program had upon energy decisions
- Whether or not measures would have been installed in the absence of the program

In the actual execution of the telephone survey, we found that most decisionmakers were not very responsive over the phone. As the majority of

participants are small businesses, the decisionmakers (owners or managers of the establishments) are usually inundated with multitude of tasks. As a result, we found that they were more responsive when approached with the questionnaire when our staff was onsite. Through a combination of this method and direct telephone calls, we completed the questionnaire for 76 sites out of the 102 sites where installation was complete at the time of report preparation (or 75% of the sample size). The rest of the visited participants declined to participate.

3. ESTIMATES OF GROSS SAVINGS

The gross savings impacts of the Commercial Lighting Program are represented by the energy savings attributable to the installation of energy efficiency lighting measures by participants in the program. We used the data collected on-site and the monitored data in analyses to estimate the energy savings of the various energy conservation measures installed. To analyze savings for lighting measures, we use our Lighting Evaluation Model. Analyzing the savings from lighting measures with this model requires data for retrofitted fixtures on (1) wattages before and after retrofit; (2) hours of operation; (3) number of fixtures replaced; and (4) burned out rate of the lamps.

- To determine baseline and post-retrofit demand values for the lighting efficiency measures, we cross-checked deemed values of savings used by SMUD against our in-house data on standard wattages of lighting fixtures and ballasts that we have in-house to determine demand values for lighting fixtures. This is supplemented by the actual power measurements for different fixtures collected onsite. Data on types and quantities of fixtures, lamps and ballasts are collected on-site.
- We collected time-of-use data with which to determine average operating hours for retrofitted fixtures by using time-of-use (TOU) data loggers to monitor a sample of "last points of control" for unique usage areas in the sites where lighting efficiency measures had been installed. Usage areas are defined to be those areas within a facility that are expected to have comparable average operating hours.

We used per-fixture baseline demand, retrofit demand, and appropriate post-retrofit operating hours to calculate peak capacity savings and annual energy savings for sampled fixtures of each usage type. The on-off profile and the fixture wattages were used to calculate post-retrofit kWh usage. We calculated demand for a fixture by averaging the hourly demand of the lighting system during the peak hours between 1 and 9 PM weekdays using the data collected through our onsite time-of-use monitoring.

We calculated Peak Period Demand Savings as the difference between peak period baseline demand and post-installation peak period demand of the affected lighting equipment, per the following formula:

$$\text{Peak Capacity Savings} = kW_{\text{Before}} - kW_{\text{After}}$$

We calculated annual energy savings for each sampled fixture per the following formula:

$$\text{Annual Energy Savings} = \text{kWh}_{\text{Before}} - \text{kWh}_{\text{After}}$$

The values for insertion in this formula were determined through the following steps:

- We used the number of fixtures for which replacement had been verified along with their associated wattages based on the type of fixture to calculate the peak capacity before and after the lighting replacement. We then adjusted this value to include the actual rate of lamp burn out just before the replacement.
- We used results from the monitored sample to calculate the average usage rate of the lighting system during the peak demand period of 1 to 9 PM weekdays, and we applied this average to the peak demand values before and after replacement. The peak capacity savings is the sum of the difference between baseline and post-installation average peak demand for all of the usage areas.
- We also used results from the monitored sample to calculate the average annual operating hours of the metered lights for every unique building type/usage area. We then applied these average operating hours to the baseline and post-installation for each usage area to calculate the respective energy consumption for each usage area.
- The annual baseline energy usage is the sum of the baseline kWh for each costing period for all of the usage areas. The post-retrofit energy usage was calculated similarly. The energy savings were calculated as the difference between baseline and post-installation energy usage.

Program-level gross savings for the 2005/06 Commercial Lighting Program were developed by applying achieved savings realization rates calculated for the analysis sample to program-level data for SMUD reported savings. Realization rates were used to describe the relationship between calculated savings and program expected savings estimates. The realization rates have been calculated as the ratio of our calculated measure savings to the SMUD reported savings. Reported savings have been developed by SMUD as part of the program application and recorded in the program tracking database.

The ratio estimate of program-level savings is given by the following formulation:

$$\hat{Y}_R = \frac{y}{x}X = \frac{X}{x}y$$

where Y_R is the estimate for program-level gross savings, y is the sample total for gross savings, x is the sample total for the auxiliary variable, and X is the population total for the auxiliary variable. For this ratio estimation of program-

level savings, estimates of expected savings from the program tracking records were used as the auxiliary information.

Due to the high occurrence of worship centers among the sampled program participants, we performed analysis of the program-level savings for two categories: worship and non-worship centers. Worship centers are known to have irregular hours of usage, while the rest of the commercial establishments have more of a regular and consistent schedule. Therefore the projection of savings based on monitored operating hours is more accurate by accounting for the two distinctly different types of commercial establishments.

3.1 VERIFIED LIGHTING FIXTURES

During our post-visit, our staff verified the quantities of high efficiency light fixtures that were actually replaced. This verification was completed in 102 sample sites where pre-installation visit had been made. The installation had either been cancelled or not been completed in 23 other sites that received a pre-visit. Since all cancelled sites are immediately removed from the master program database by SMUD, the program savings do not factor in those cancellations. Table 3-1 presents the quantities of different light fixtures that have been verified to be fully installed and functional. The high verification rate for conversion from 2-four-foot T12 to 2-four-foot T8 can be attributed to the incorrect assumption made by the contractors that the light fixtures were originally fixtures of 4-four-foot T12. Delamping from 4-four-foot T12 fluorescent to 2-four-foot T8 fluorescent made up 58% of all fluorescent tube replacement claims submitted by the contractors, and only 78% of such cases were actually verified.

The verified installed rate for all replacements from incandescent to compact fluorescent lamps is averaging 77%. In a number of cases, the contractors left the compact fluorescent lamps with the customers without installing them. At the time of our post-visit, it was found that the majority of these lamps were left uninstalled as the customers could not afford the labor to install them. These uninstalled lamps have not been included in the gross savings calculations.

Table 3-1 Quantities of Fixture Replacement Submitted and Verified for the Sample Sites

Pre	Post	Non-Worship	Worship	Total	Non-Worship	Worship	Total	Non-Worship	Worship	Grand Total
2L4'T12	2L4'T8	51	4	55	285	46	331	559%	1150%	602%
2L4'T12	1L4"T8	43	-	43	43	-	43	100%	-	100%
3L4'T12	2L4'T8	342	334	676	353	205	558	103%	61%	83%
4L4'T12	3L4'T8	-	-	-	-	71	71	-	-	-
4L4'T12	2L4"T8	876	1773	2649	626	1434	2060	71%	81%	78%
2L8'T12	4L4'T8	19	-	19	-	-	-	-	-	0%
2L8'T12	3L4'T8	134	-	134	111	-	111	83%	-	83%
2L8'T12	2L4'T8	931	39	970	940	39	979	101%	100%	101%
4L8'T12	4L4'T8	30	-	30	30	-	30	100%	-	100%
INC	NRCFL<=25	2071	370	2441	1498	326	1824	72%	88%	75%
INC	NRCFL26-64W	478	665	1143	455	397	852	95%	60%	75%
INC	NRCFL>=65W	0	-	0	2	-	2	0%	-	0%
INC	RCFL<=25W	1320	161	1481	1059	153	1212	80%	95%	82%
INC ES	LED ES	213	277	490	145	255	400	68%	92%	82%

Key: 2L4'T12: fixture of 2 lamp 4-foot T12 fluorescent
NR CFL<=25: Non Reflector Compact Fluorescent Lamp at or under 25 W

3.2 VERIFIED OPERATING HOURS

Table 3-2 presents the verified average operating hours and peak demand hours (weekdays 1-9 PM) for the replaced fixtures. The operating parameters presented in this table are obtained through time-of-use monitoring consistent with the procedure outlined previously. The verified operating hours of non-worship commercial facilities are fairly consistent with those submitted by the contractors. The verified operating parameters for worship centers, however, are significantly lower than the submitted values. In the submission of site operating hours to SMUD, the contractors often submit the hours that the facility is open to the public. For worship facilities, although the facility itself may be open, very little usage of the building can be expected during weekdays. Typically, only a small section of the facility, for example the office, is open during this time. The bulk of activities normally take place in the weekend.

Table 3-2 Verified Operating Hours

Type of Establishment	*Expected*		*Verified*	
	Average Operating Hours	*Average Peak Demand Hours*	*Average Operating Hours*	*Average Peak Demand Hours*
Non-Worship	4,134	6.3	4,010	6.1
Worship	4,127	6.6	2,284	3.2

3.3 VERIFED FIXTURE WATTAGES AND LIGHTING LEVELS

Clamp-on power measurements were performed at 44 sites where light fixtures were replaced. Table 4-3 presents the average wattages for different light fixtures replaced. Table 4-4 presents the expected and verified average savings for different replacement combinations. The verified average savings is used in the program gross savings calculations.

Table 3-3 Measured Average Wattages

Fixture	*Average Measured Wattage*
2L4'T12	77
2L8'T12	120
3L4'T12	113
4L4'T12	138
2L4'T8	69
4L4'T8	100
Incandescent Non-Reflector <= 25 W*	67
Incandescent Reflector <= 25 W*	86
CFL Non-Reflector <= 25 W*	15
CFL Reflector <= 25 W*	15

*Based on visual inspection onsite

Table 3-4 Expected and Verified Fixture Savings Based on Clamp-On Power Measurements

Replacement Type	*Expected Savings (W)*	*Verified Savings (W)*
2L4'T12 to 2L4'T8	12	8.4
3L4'T12 to 2L4'T8	56	44.5
4L4'T12 to 2L4'T8	90	69.0
4L4'T12 to 4L4'T8	36	38.2
2L8'T12 to 4L4'T8	48	20.1
2L8'T12 to 2L4'T8	102	50.8
4L8'T12 to 8L4'T8	96	40.1
4L8'T12 to 4L4'T8	208	139.9
Incandescent-CFL Non-Reflector <=25W	30	51.6
Incandescent-CFL Reflector <=25W	55	71.4

Lighting level measurements were taken in delamped areas. On average, the lighting quality after the delamping process improved by 9.9 footcandles (fc). Table 3-4 presents the statistics of the lighting level measurements taken at 107 delamped areas. The increase in lighting quality could be attributed to the presence of burned out lamps and lamp or ballast degradation before the replacement. Figure 4-1 presents a scatter-plot of the lighting level measurements before and after replacement.

Table 3-5 Light Level Measurements
Before and After Replacement of Light Fixtures

Statistic	*Before (fc)*	*After (fc)*	*Difference (fc)*
Mean	36.5	46.4	9.9
Standard Deviation	19.6	18.6	18.8
Min	0.0	9.0	(46.0)
Max	105.2	101.4	76.9
No. of Areas Worse After	27		
No. of Areas Better After	80		

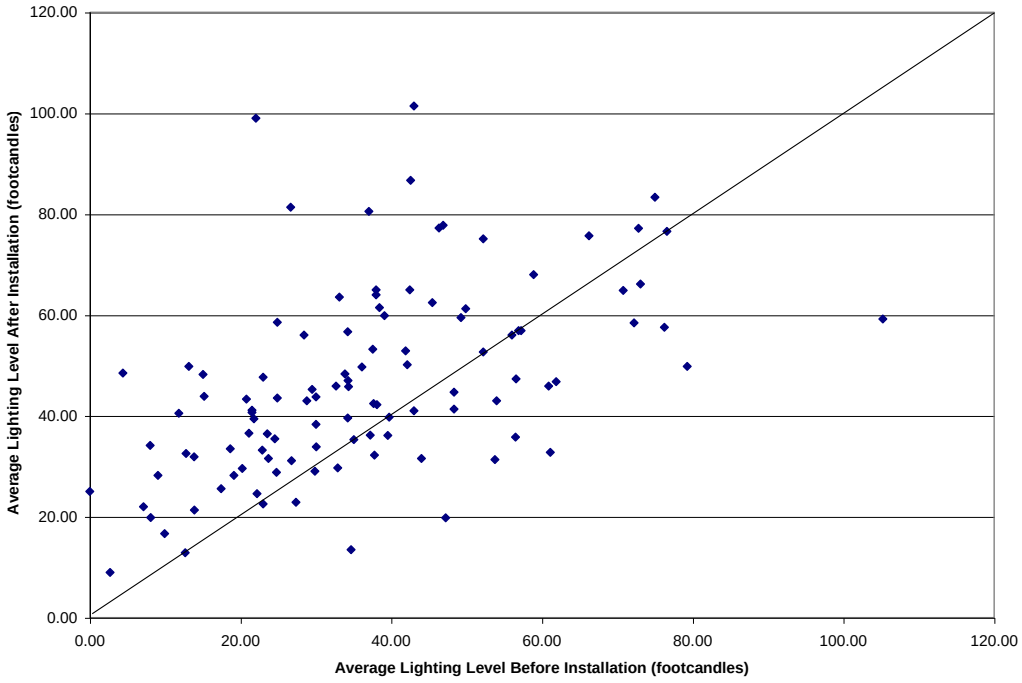

Figure 3-1 Scatter-Plot of Light Level Measurements Before and After Replacement

3.4 LAMP BURN OUT RATE

The number of burn out lamps was collected during our first visit. The data collected are factored into the calculations of gross savings for the program. Table 3-6 presents the average burn out percentage of lamps by the type of fixture.

Table 3-6 Percentage of Burned Out Lamps By Type of Lamps

Type of Fixture	*Burned Out Percentage*
2L4'T12	5%
3L4'T12	15%
4L4'T12	16%
2L8'T12	23%
3L8'T12	6%
4L8'T12	29%
Incandescent Non-Reflector CFL <= 25W	9%
Incandescent Non-Reflector CFL 26-64W	3%
Incandescent Reflector CFL <= 25W	16%
Incandescent Reflector CFL > 25W	4%

3.5 ESTIMATES OF PROGRAM-LEVEL GROSS SAVINGS

The estimates of program-level savings that were calculated separately for the type of facility (i.e. worship and non-worship) are brought together in this section to provide the estimated overall gross savings for the program. Based on the calculations of the gross savings for the 102 sampled sites, the expected and verified savings, as well as the realization rates are presented in Table 3-7.

Table 3-7 Estimated Gross Savings and Realization Rates for Sampled Sites

Type of Facility	*No. of Sample Sites*	*Expected kW Savings*	*Verified kW Savings*	*Realization Rate (kW)*	*Expected kWh Savings*	*Verified kWh Savings*	*Realization Rate (kWh)*
Worship	27	201	57	28%	898,706	331,710	37%
Non-Worship	75	277	217	78%	1,383,548	1,132,991	82%
Total	102	477	274	57%	2,282,254	1,464,702	64%

Projecting the realization rates for worship and non-worship facilities to the overall gross program savings for 2005 and 2006, the results are summarized in Tables 3-8 and 3-9 respectively. The cumulative gross program savings are

presented in Table 3-10. Please note that the program is still ongoing for 2006 at the time of report writing.

Table 3-8 Estimated Program Gross Savings for 2005

Type of Facility	*No. of Sample Sites*	*Expected kW Savings*	*Verified kW Savings*	*Realization Rate (kW)*	*Expected kWh Savings*	*Verified kWh Savings*	*Realization Rate (kWh)*
Worship	79	465	132	28%	2,104,301	776,693	37%
Non-Worship	239	990	775	78%	5,152,514	4,219,409	82%
Total	318	1,455	907	62%	7,256,815	4,996,102	69%

Table 3-9 Estimated Program Gross Savings for 2006

Type of Facility	*No. of Sample Sites*	*Expected kW Savings*	*Verified kW Savings*	*Realization Rate (kW)*	*Expected kWh Savings*	*Verified kWh Savings*	*Realization Rate (kWh)*
Worship	8	56	16	28%	248,084	91,567	37%
Non-Worship	50	391	306	78%	2,104,386	1,723,288	82%
Total	58	446	322	72%	2,352,470	1,814,855	77%

Table 3-10 Estimated Program Gross Savings for 2005/06

Type of Facility	*No. of Sample Sites*	*Expected kW Savings*	*Verified kW Savings*	*Realization Rate (kW)*	*Expected kWh Savings*	*Verified kWh Savings*	*Realization Rate (kWh)*
Worship	87	521	147	28%	2,352,385	868,260	37%
Non-Worship	289	1,381	1,081	78%	7,256,900	5,942,696	82%
Total	376	1,902	1,228	65%	9,609,285	6,810,957	71%

4. ESTIMATES OF NET IMPACTS OF PROGRAM

Net savings represent that part of gross savings achieved by program participants that can be attributed to the effects of the program.

4.1 PROCEDURES USED TO ESTIMATE NET SAVINGS

The second major aspect of the Commercial Lighting Program evaluation is to estimate net savings. The data needed for the net-to-gross analysis pertain to customers' decision-making criteria and their attitudes and behavior. Essentially, the customers need to be questioned regarding their knowledge of SMUD's programs, their level of interest in the programs, their reasons for participating, and the measure implementation decisions they would have made had they not participated in SMUD's program.

The information needed to perform the net-to-gross analysis is collected through a decision-makers survey. The decision-maker interviews are used to collect information from the customers participating in the Commercial Lighting Program regarding their decisions to install energy efficiency measures.

The relationship between net savings, gross savings, free-ridership impacts and spillover impacts is given by the following equation:

Net Program Savings Impact = Gross Program Savings Impact - Freeridership Impacts + Spillover Impacts

Gross Program Savings Impact is the energy savings impact attributable to the installation of energy efficiency measures by participants. Free ridership impacts are the energy savings impact attributable to the installation of energy efficiency measures by participants who are free riders. Spillover pertains to several effects. First, non-participants may adopt measures promoted by the program as a direct result of the program but do so outside of the program. One savings impact of free-drivership is the additional energy savings that result because non-participants purchase greater efficiency then they otherwise would have, due to differences in dealer and contractor actions (e.g. different stocking practices). There may also be additional energy savings from non-participants due to program marketing impact on awareness of energy-efficiency. Second, participants may be influenced by the program to invest in energy-efficient measures not included in the program. The goal of the net-to-gross analysis is to infer the magnitude of these effects and hence to determine the net savings impact of the Commercial Lighting Program.

Free riders for a utility's 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 is to estimate the impacts of energy efficiency measures attributable to SMUD's Commercial Lighting Program that are net of such free riders. Because energy savings realized by free riders are not induced by the program, these savings should not be included in estimating the program's actual impacts.

Defining a "free rider" as a program participant who would have adopted the same energy efficiency measures without the program seems at first glance to be straightforward. However, further reflection reveals important elements to consider when applying this definition to arrive at estimates of free-ridership. Most obviously, given that a program does exist, it is impossible to know exactly what participation decision would have been made if the program did not exist. In other words, we cannot be totally sure what the decision outcome would be if the program option were not available to the decision maker. The goal of the analysis is to infer the decisions that would have been made in the absence of the program and to use these inferences to determine how the program altered customers' decisions.

Although various methodological procedures have been used to develop estimates of free-ridership for a DSM program, some of these techniques (e.g., discrete choice modeling) have been designed to work on a statistical basis on relatively large samples. Because those circumstances do not apply here, we develop net-to-gross ratios using information collected from customers on their decision-making regarding specific measures they installed.

Information collected from program participants during the decision-makers survey is used for the net-to-gross analysis. Based on review of this information, the preponderance of evidence about free-ridership inclinations is used to determine whether to attribute some or all of a customer's savings to free-ridership. Five sets of rules are used for determining what percentage of a customer's savings for a particular type of measure should be attributed to free-ridership.

The first set of rules considers whether a customer indicates that previous participation in a SMUD program or a recommendation from a SMUD account executive was important to the decision to install a particular piece of equipment or measure. Two sets of questions are asked for this set of rules.

- A customer is first asked: "How important was previous experience with a SMUD program in making your decision to install [Equipment/Measure]?" A customer's answer is first cross-checked against the answers to an earlier question as to which, if any, programs a customer had previously participated

in. If a customer indicated that they had not previously participated in a program, then their answer to this question regarding the importance of previous experience is considered null. However, if a customer who had previously participated in a program answers that the previous experience was "Very Important", then that customer is considered to have been influenced by SMUD and is not a free rider.

- A customer is also asked: "Did a SMUD contractor recommend that you install [Equipment/Measure]?" If a customer answers "Yes", he/she is then asked: "If the SMUD contractor had not recommended installing [Equipment/Measure], how likely is it that you would have installed [Equipment/Measure] anyway?" If a customer answers "Probably would not have installed" or "Definitely would not have installed", then that customer is again considered to have been influenced by SMUD and is not a free rider. Other combinations of answers to these questions lead to consideration of the other rules for assigning free-ridership status.

A second rule pertains to the financial ability of a customer to have installed an energy efficiency measure without SMUD's financial incentive. A customer is asked: "Would you have been financially able to install [Equipment/Measure] without SMUD's financial incentive?" A customer who answers "No" to this question is considered to not be a free rider. Further confirmation for this assignment is made by asking the customer: "If SMUD's **financial incentive** had not been available, how likely is it that you would have installed [Equipment/Measure] anyway?" A customer is not considered to be a free rider if he/she answers "Probably would not have installed" or "Definitely would not have installed".

With the first two sets of rules, a customer who is determined to have been influenced by SMUD or who would have been financially unable to install the equipment/measure without financial incentives is considered to not be a free rider. If a customer is determined to not be a free rider through application of the first two rules, then the other sets of rules do not apply. The other rules do come into play in cases where the first two sets of rules leave open the possibility that a customer may be a free rider.

The third set of rules considers whether a customer indicates that he/she had previously installed an energy efficiency measure similar to one that they installed under the SMUD program. A customer indicating that he had installed a similar measure is provisionally considered to be a free rider. Operationally, this means that a customer is considered a free rider who answers "Yes" to the question "Before participating in the SMUD program, had you installed any equipment/measure similar to the measure for which you received a financial incentive from SMUD at your facility?"

The fourth set of rules considers whether a customer states that his/her intention was to install an energy efficiency measure even without the SMUD program. The answers to a combination of three questions are used with this set of rules to determine whether a customer's savings for a measure is attributable to free-ridership.

- "Did you have plans to install the measure before participating in the SMUD program?"
- *If answered "Yes" to preceding question: "*Would you have gone ahead with this planned installation of the measure even if you had not participated in the SMUD program?"
- "If SMUD's financial incentive had not been available, how likely is it that you would have installed the measure anyway?"

For a customer who answers "Yes" to the first two questions and answers "Definitely would have installed" or "Probably would have installed" to the third question, that customer's savings for the measure are provisionally attributed to free-ridership.

A fifth set of rules considers partial free-ridership for those customers whose savings are attributed to free-ridership when the third and fourth sets of rules are applied. Even a customer whose savings might have been attributed to free-ridership by the third and fourth sets of rules might still have been induced by the program to install energy efficient equipment in greater numbers or of higher efficiency than he otherwise would have. That is, a customer could have installed lighting equipment with higher efficiency than the baseline even without the incentive offered by the SMUD program but not as high as the efficiency actually installed because of the program's incentive. Moreover, the program might have induced the purchase and installation of energy efficient equipment earlier than otherwise was planned. Under these circumstances, part of the savings a customer realized with a measure could be attributed to the program, while the other part could be attributed to free-ridership.

To determine the extent of partial free-ridership savings attributable under this fifth set of rules, information as to the efficiency of equipment that a customer would have installed absent the SMUD program is obtained through the interviewing of program participants either on-site or by telephone. In particular, for each of the different kinds of measures, a customer is asked the following question: "How did the availability of information and financial incentives through SMUD's program affect the level of energy efficiency you chose for the measure that you installed?" Any customer whose savings had been attributed to free-ridership by the preceding rules but who indicated in his/her answer to this question that the efficiency of the equipment they installed under the program is

better than he/she otherwise would have chosen is considered to have some savings that were induced by the program. Only part of the savings reflected free-ridership.

For a customer who is determined to have savings that reflect only partial free-ridership, some of the savings that customer realized from installing energy efficiency measures through the SMUD program has to be credited to the program. The amount of savings attributable to partial free-ridership *versus* the amount to be credited to the program are determined through a decomposition analysis of total energy savings. For this analysis, savings are partitioned into two components by comparing energy use for different combinations of efficiency conditions:

- Energy Use(standards or baseline efficiency) – Energy Use(efficiency that customer would have installed in absence of program)
- Energy Use(efficiency that customer would have installed in absence of program) – Energy Use(efficiency that customer actually installed because of program)

The first component represents savings arising from free-ridership, while the second component represents program-induced savings, which are the additional savings that result from going from the energy efficiency level without the program to the energy efficiency program with the program. The estimates of energy use that are used for this analysis are developed during the analysis of gross savings.

Participant free-drivership impacts can be associated with those program participants who had *not* previously installed energy efficient measures but who had installed some non-rebated measures and indicated that the program had some influence on that decision. Information with which to assess the extent of such participant spillover effects is collected through the decision-makers survey of program participants. The answers to three questions are used in analyzing the extent to which there are "free driver" effects associated with non-rebated purchases by program participants. These questions are as follows:

- Has your organization purchased any energy efficient equipment in the last two years for which you did not apply for a rebate through one of SMUD's energy efficiency incentive programs?
- Before you knew about SMUD's energy efficiency incentive programs, had you purchased and installed any energy efficient equipment at this facility?
- Has your experience with the SMUD program led you to buy any energy efficient equipment for which you did not apply for a rebate?

If a customer answers "yes" to the first question, "no" to the second question, and "yes" to the third question, the customer is considered to show some free-drivership.

4.2 ESTIMATES OF NET SAVINGS OF PROGRAM

The procedures described in the preceding section were used to determine net savings for two different types of facility, worship and non-worship.

4.2.1 Net Savings Results

The weighted free-ridership impact of the program for the two different types of commercial facilities based on their responses to the questionnaire is summarized in Table 4-1. The results of the net savings analysis for program year 2005, 2006 and the entire 2005/06 program are presented in the Tables 4-2 through 4-4. The net-to-gross ratios derived for the surveyed sites are applied to program-level gross verified savings to develop estimates of program-level net verified savings. Based on customer responses, it has been determined that there is no spillover impact for the program.

Table 4-1 Rate of Free-Ridership By Type of Facility

Type of Facility	*Free Ridership Rate (kWh)*	*Free Ridership Rate (kW)*
Worship	14.1%	18.6%
Non Worship	2.1%	2.1%
Combined	4.3%	4.9%

Table 4-2 Estimated Net Program Savings for 2005

Type of Facility	*No. of Sample Sites*	*Expected kW Savings*	*Verified Gross kW Savings*	*Verified Net kW Savings*	*Expected kWh Savings*	*Verified Gross kWh Savings*	*Verified Net kWh Savings*
Worship	79	465	132	107	2,104,301	776,693	666,843
Non-Worship	239	990	775	759	5,152,514	4,219,409	4,132,120
Total	318	1,455	907	866	7,256,815	4,996,102	4,779,757

Table 4-3 Estimated Net Program Savings for 2006

Type of Facility	*No. of Sample Sites*	*Expected kW Savings*	*Verified Gross kW Savings*	*Verified Net kW Savings*	*Expected kWh Savings*	*Verified Gross kWh Savings*	*Verified Net kWh Savings*
Worship	8	56	16	13	248,084	91,567	78,617
Non-Worship	50	391	306	300	2,104,386	1,723,288	1,687,638
Total	58	446	322	312	2,352,470	1,814,855	1,736,267

Table 4-4 Estimated Net Program Savings for 2005/06 Program

Type of Facility	*No. of Sample Sites*	*Expected kW Savings*	*Verified Gross kW Savings*	*Verified Net kW Savings*	*Expected kWh Savings*	*Verified Gross kWh Savings*	*Verified Net kWh Savings*
Worship	87	521	147	120	2,352,385	868,260	745,460
Non-Worship	289	1,381	1,081	1,059	7,256,900	5,942,696	5,819,758
Total	376	1,902	1,228	1,179	9,609,285	6,810,957	6,516,023

5. LESSONS LEARNED

This chapter provides data and discussion regarding lessons learned about the Commercial Lighting Program. These lessons are based on observations made while working with the data from the program tracking system, while collecting data on-site or through the telephone survey, and while analyzing the data.

5.1 LESSONS LEARNED DURING REVIEW AND ANALYSIS OF DATA

Based on the flow of information from contractor to SMUD as observed through this evaluation process, there are several areas that can be improved to increase program transparency and customer satisfaction:

- The time between the submission of initial paperwork and the time the job is completed can be overly long. Some customers expressed their frustration informally that the timeframe of installation is too long or that they are left out completely out of the loop for months, without any notice from SMUD or the contractor. In the paperwork presented to SMUD and customer, contractors should state the estimated timeframe for the project to be completed, so that the customers can make the appropriate arrangements if necessary.
- The majority of fluorescent tube replacement involves delamping of four four-foot T12 to two four-foot T8 (58% of all fixtures). Altogether, only 11% of all fluorescent tube replacements are one-to-one replacements. Furthermore a large portion of non-delamping replacements were claimed as delamping replacements in the paperwork submitted to SMUD. This disparity can be traced to the substantial difference in incentives for delamped and one-to-one replacements that made it a lot more difficult for the contractors to sell one-to-one replacement projects due to the extra costs that have to be passed on to the customers. Although the lighting level measurements indicated that the lighting level actually improved despite delamping, the current incentive levels offered will drive the contractors to push only for delamping, regardless of the existing lighting level in the areas to be delamped.

5.2 LESSONS LEARNED FROM CUSTOMERS THROUGH ONSITE SURVEY

The onsite survey conducted revealed several deficiencies that could be improved in future programs.

- At the beginning of the program, some of the contractors did not submit accurate information about the quantities and types of fixtures to be replaced. Although for the majority of cases this information was later corrected in the submission of invoice, emphasis should be placed on the contractors to submit

accurate information throughout the process to increase program transparency.

- Some contractors did not provide installation of compact fluorescent lamps to the customers. At the time of our onsite survey, we found that many of the compact fluorescent lamps provided by the contractors were left uninstalled as the customers could not afford the time or cost of installation. In the program gross savings calculations, compact fluorescent lamps left uninstalled were excluded from the calculations of gross savings.
- In certain instances, the customers were not informed of the quantities, type and timeframe of replacement. Several customers informed our site survey personnel that they were only told that the lights were going to be replaced, without any knowledge on their part on the details of the process. We would recommend that the customers be notified in writing of the details of the installation to improve program transparency.

5.3 LESSONS LEARNED FROM CUSTOMERS THROUGH TELEPHONE SURVEY

As part of the evaluation work effort, a telephone survey was conducted of all participants in the Commercial Lighting program. The total number of respondents to this survey was 76.

Using the survey instrument provided in Appendix C, each respondent was asked questions about (1) their general decision making regarding purchasing and installing energy efficient equipment, and (2) their knowledge of and satisfaction with the Commercial Lighting Program.

Tabulations of the survey responses are presented in this section. There are two sets of tables.

- The first set of tables pertain to customers' general decision making about purchasing and installing energy efficient equipment.
- The second set of tables pertain to customers' experience with the Commercial Lighting Program.

The responses to the telephone survey provide some guidance as to possible changes in the design and/or implementation of the Commercial Lighting Program. Moreover, the responses provide some indication of what customers like and dislike about the program.

- Contractor's approach makes up 76% of the program enrollment. This underlines the role of the contractor as the initiator of the program. The higher number of the contractors that participate in the program, the better the likelihood that more customers will be enrolled in this program.

- Eleven percent of the customers interviewed demonstrated no awareness that the program is paying for a large portion of the installation costs.
- Energy costs appear to be the dominant factor in why the customers decided to replace their lighting. 92% of the respondents answered that this was their primary motivation in replacing the lights.

Overall, customers appeared satisfied with the program.

- 76% of the customers responded that they are "very satisfied" with the program, while 19% responded that they are "somewhat satisfied."
- Upwards of 80% of the respondents rated the service they received from the contractors as either "excellent" or "good" in several categories. Most of the dissatisfaction lies with the timing of the timing of work completion.
- 72% of the respondents appeared to have improved opinion of SMUD as the direct result of this program, and not a single respondent answered that the program has caused a worse opinion of SMUD.

Customers' satisfaction with the program was also evident in the comments that they made during the telephone interviews. However, some customers did note problems.

- Three (3) customers commented that the timeliness of project completion was disappointing.
- Three (3) customers commented that the contractors should do a better job in scheduling appointments and keeping the customers up to date with project status.
- Two (2) customers suggested that the contractors follow up with the project after the installation has been completed to check on how the equipment is operating.

5.3.1 Customers' Decision Making

How did you first hear about the Commercial Lighting Program?	*Response*	*(n=75)*
	Received information in mail	5%
	Was contacted by contractors	76%
	SMUD bill message	4%
	Others	13%
	Don't know	1%

How easy was it for you to understand the requirements for participating in the Commercial Lighting Program?	*Response*	*(n=76)*
	Very easy	76%
	Somewhat Easy	20%
	Very Difficult	1%
	Don't Know	3%

How helpful was the contractor's staff in answering questions about energy efficient lighting equipment and providing professional support?	*Response*	*(n=76)*
	Very helpful	80%
	Somewhat helpful	14%
	Not very helpful	3%
	Not at all helpful	1%
	Don't know	1%

Did the contractor tell you that SMUD was providing a rebate that the contractor was applying to reduce the cost of installing the energy efficient lighting equipment?	*Response*	*(n=76)*
	Don't know	4%
	No	7%
	Yes	89%

How influential was SMUD's rebate or incentive in your decision to have the energy efficient lighting equipment installed?	*Response*	*(n=74)*
	Very influential	85%
	Somewhat influential	5%
	Not very influential	7%
	Not at all influential	1%
	Don't know	1%

How important was past experience with energy efficient lighting equipment in making your decision to install new types of energy efficient lighting equipment for this facility?	*Response*	*(n=74)*
	Very important	42%
	Somewhat important	18%
	Only slightly important	8%
	Not important at all	26%
	Don't know	7%

How important was advice and/or recommendations from the lighting contractor in your decision making on energy efficient lighting improvements?	*Response*	*(n=75)*
	Very Important	55%
	Somewhat important	38%
	Only slightly important	5%
	Not important at all	3%

Why did you choose to have the energy efficient lighting equipment installed?	*Response (Multiple Responses Possible)*	*(n=76)*
	Wanted to save money on energy costs	92%
	Wanted to be environmentally friendly/conscious	21%
	Save money on the cost of equipment	12%
	Other	3%
	Don't Know	1%

Did you have plans to install new lighting system before participating in the program?	*Response (Multiple Responses Possible)*	*(n=74)*
	No	78%
	Yes	22%

Would you have gone ahead with this planned installation even if you had not participated in the program?	*Response*	*(n=13)*
	No	23%
	Yes	77%

How important was experience with a previous SMUD program in making your decision to install new lighting system?	*Response*	*(n=75)*
	No previous experience	80%
	Very important	5%
	Somewhat important	5%
	Only slightly important	5%
	Not important at all	1%
	Don't know	3%

Did the contractor recommend or select the new equipment?	*Response*	*(n=73)*
	No	14%
	Yes	86%

If the SMUD contractor had not recommended installing new lighting system, how likely is it that you would have installed the same system anyway?	*Response*	*(n=54)*
	Definitely would have installed	7%
	Probably would have installed	17%
	Probably would not have installed	46%
	Definitely would not have installed	22%
	Don't know	7%

Would you have been financially able to install new lighting system without SMUD's financial incentive?	*Response*	*(n=75)*
	Don't know	17%
	No	65%
	Yes	17%

If SMUD's financial incentive had not been available, how likely is it that you would have installed [Equipment/Measure] anyway?	*Response*	*(n=75)*
	Definitely would have installed	1%
	Probably would have installed	19%
	Probably would not have installed	45%
	Definitely would not have installed	29%
	Don't know	5%

	Response	*(n=67)*
How did the availability of information and financial incentives through SMUD's Commercial Lighting Program affect the quantity (number of units) of [Equipment/Measure] that you purchased and installed?	Purchased and installed more equipment measures than otherwise would have	24%
	Did not affect quantity purchased and installed	76%

	Response	*(n=65)*
How did the availability of information and financial incentives through SMUD's Commercial Lighting Program affect the level of energy efficiency you chose for [Equipment/Measure]?	Efficiency of equipment was better than otherwise would have chosen	45%
	Did not affect level of efficiency that we chose for equipment	52%

	Response	*(n=68)*
How did the availability of information and financial incentives through SMUD's Commercial Lighting Program affect the timing of your purchase and installation of [Equipment/Measure]?	Purchased and installed equipment/measure earlier than otherwose would have	48%
	Did not affect timing and purchase and installation	54%

5.3.2 Customers' Satisfaction with Commercial Lighting Program

	Response	*(n=72)*
How well would you say the service you received from the lighting contractor for the Commercial Lighting Program met your expectations?	It met all of your expectations	72%
	It met some of your expectations	26%
	It did not meet your expectations at all	1%

Please think about your <u>overall</u> experience with the service you received in having the energy efficient lighting equipment installed. Consider all aspects of your experience with that service. <u>Overall</u>, how would you rate your satisfaction with the service provided to you. Would you say you were very satisfied, somewhat satisfied, somewhat dissatisfied, or very dissatisfied?	*Response*	*(n=74)*
	Very satisfied	76%
	Somewhat satisfied	19%
	Somewhat dissatisfied	1%
	Very dissatisfied	1%
	Would not answer	1%

We now want to ask you more specifically about different features of the service you received in having the energy efficient lighting equipment installed. Using the scale: Excellent, Good, Fair or Poor How would you rate the service on the following features: Information you received from contractor explaining energy efficient lighting equipment	*Response*	*(n=75)*
	Excellent	51%
	Good	41%
	Fair	7%
	Poor	1%
	Not Applicable	0%

Contractor's expertise and experience	*Response*	*(n=74)*
	Excellent	51%
	Good	44%
	Fair	3%
	Poor	1%
	Not Applicable	0%

	Response	*(n=73)*
Cost of installing the equipment	Excellent	1%
	Good	52%
	Fair	19%
	Poor	3%
	Not Applicable	23%

	Response	*(n=74)*
Quality of the contractor's work in installing the energy efficient lighting equipment	Excellent	57%
	Good	29%
	Fair	7%
	Poor	1%
	Not Applicable	4%

	Response	*(n=74)*
Completion of the work as promised	Excellent	53%
	Good	35%
	Fair	4%
	Poor	3%
	Not Applicable	4%

	Response	*(n=74)*
Has your experience with the Commercial Lighting Program affected your opinion of SMUD, and if so, how?	Yes, Improved opinion	72%
	No, Has not affected opinion	28%
	Yes. Worsened opinion	0%

6. SUMMARY AND CONCLUSIONS

The success of Prescriptive Commercial Lighting Program is highly dependent on the ability of the contractors to recruit customers. The type of establishments enrolled in the program is also closely tied to the target audience of the contractors. In the program year 2005/06, a significant portion of the program enrollment belongs to worship facilities that have highly inconsistent occupancy. Table 6-1 presents the summary of the realization rates for each category of commercial establishments (worship or non-worship), and as it can be seen, the realization rates for worship facilities are substantially lagging the rates of non-worship facilities, while the free ridership rates for the former are also significantly higher than the latter. The realization rates for the gross program savings take into consideration the quantity and wattages of the lamps based on onsite data collection, actual operating hours based on time-of-use monitoring, and the burn out rate of the lamps. Since 76% of the interviewed customers responded that their enrollment in the program was initiated by contractor's approach, the disparity in the types of facility enrolled could be addressed by having more contractors with diverse backgrounds participating in the program.

Table 6-1 Realization Rates and Distribution of Facility Types

Type of Facility	*Distribution By Type*	*Realization Rate (kW)*	*Realization Rate (kWh)*	*Free Ridership Rate (kWh)*	*Free Ridership Rate (kW)*
Worship	23.1%	28%	37%	14.1%	18.6%
Non-Worship	76.9%	78%	82%	2.1%	2.1%
Combined (All Participants)	100.0%	65%	71%	4.3%	4.9%

Overall, customers that enrolled in the program appeared to be satisfied with the program. Of all the customers interviewed, 95% have a favorable ("very satisfied" or "somewhat satisfied") impression of the program. A large majority of respondents also expressed satisfaction with all aspects of the program, including the role that the contractors played in ensuring that the lights were replaced with the appropriate equipment. Although delamping was done on 89% of all fixtures replaced, the lighting levels on the average did not appear to have suffered because of it. The lighting levels measured in delamped areas were found to increase by an average of 9.9 footcandles

Appendix A
Listing of Sample Sites

Table A-1. Listing of Sites in Study Sample and Expected Savings

ID	Name	Type of Business	Expected kW	Calculated Peak kW	Expected Savings (kWh)	Calculated Energy Savings (kWh)
8004208	YMCA Greater Sacramento Area	Non-Worship	1.161	0.13	4,875	602
8004285	College Oak Nursing & Rehabilitation	Non-Worship	7.108	1.73	55,212	5869
8004307	Mccreerys Home Furnishings	Non-Worship	12.797	9.81	51,106	36534
8004309	Mccreery Furniture	Non-Worship	7.346	0.00	32,054	0
8004360	A New You	Non-Worship	0.536	0.46	1,949	1576
8004409	Gloria Dei Lutheran Church & School	Worship	14.146	10.72	65,293	60166
8004412	Sacramento Nichiren Buddhist Church	Worship	1.945	2.26	10,108	13978
8004421	Shannons House	Non-Worship	7.571	14.25	28,557	51072
8004438	Dsi -Southgate Clinic	Non-Worship	5.720	2.05	30,560	12998
8004439	Dsi - University Clinic	Non-Worship	0.486	0.14	2,561	556
8004440	D And L Furniture	Non-Worship	5.690	1.93	20,138	7066
8004441	D And L Furniture	Non-Worship	6.024	10.99	21,322	48602
8004449	California Party Time Inc.	Non-Worship	3.320	2.70	10,874	9342
8004451	Heritage Convalescent Nursing Home	Non-Worship	4.869	6.84	32,464	42658
8004452	Dr. Steven Hammer	Non-Worship	0.972	0.37	3,295	1337
8004454	Law Enforcement Chaplaincy	Worship	0.992	0.49	4,246	1600
8004467	Park Sacramento	Non-Worship	14.866	11.85	111,145	48170
8004467	Park Sacramento	Non-Worship	14.866	9.29	111,145	109271
8004473	Ultra Glass	Non-Worship	1.033	0.49	4,710	1997
8004480	Faith Lutheran Church	Worship	6.795	3.44	42,450	12435
8004495	T.M.S.	Non-Worship	3.276	2.91	14,537	25450
8004520	Parkway Church Of Christ	Worship	10.937	2.01	43,965	8064
8004523	Thompson's Funeral Home	Non-Worship	2.129	3.99	12,751	15151
8004524	Central International	Worship	6.662	0.87	31,825	3659
8004525	Messiah Lutheran Church	Worship	7.060	0.41	27,148	3280
8004527	Launderland	Non-Worship	1.543	0.76	8,545	6647
8004532	The Carmichael Bible Church	Worship	18.945	0.77	82,059	2918
8004534	Presentation Catholic School	Worship	12.962	3.57	66,723	14857
8004535	The Carmichael Bible Church	Worship	8.209	0.92	33,631	4019
8004564	Atv Production Center	Non-Worship	5.197	5.63	21,618	21932
8004576	Ywca Sacramento	Non-Worship	7.693	8.35	57,337	29515
8004577	Sacramento Homng Alliance Church	Worship	11.362	5.45	63,119	36754
8004579	Immanuel Baptist Church	Worship	1.764	1.12	6,709	6766
8004581	Oak Hills Church	Worship	10.608	1.98	46,552	12276
8004597	Rosewood Terrace	Non-Worship	4.999	3.12	38,831	27312
8004635	Reds Plumbing Supply	Non-Worship	0.567	0.00	2,600	0
8004636	Correctional Peace Officers Foundation	Non-Worship	10.170	5.89	51,709	20430
8004658	Creekside Pet Resort	Non-Worship	0.557	0.43	3,089	2959

ID	Name	Type of Business	Expected kW	Calculated Peak kW	Expected Savings (kWh)	Calculated Energy Savings (kWh)
8004659	Carmichael SDA Church	Worship	3.888	1.12	23,722	9595
8004668	Citrus Heights SDA Church	Worship	4.513	0.43	13,951	3534
8004669	Creative Frontiers	Non-Worship	7.517	3.74	33,357	14355
8004670	Faith Christian Academy	Worship	2.170	0.10	9,397	497
8004671	Sylvan Oaks Christian Church	Worship	4.422	0.20	20,248	613
8004674	India Market	Non-Worship	5.589	4.28	19,634	18810
8004675	Vfw Post 67	Non-Worship	3.431	0.86	15,774	3447
8004676	Madison Ave Baptist	Worship	6.677	3.02	22,279	22851
8004679	Fuqua Physical Therapy	Non-Worship	5.269	1.87	21,107	7120
8004686	Furniture Source	Non-Worship	3.175	2.55	12,328	9924
8004688	Appliance Parts Center	Non-Worship	1.906	1.86	7,329	6681
8004689	Furniture Superstores	Non-Worship	2.142	1.24	8,318	4932
8004702	Indian Motorcycle	Non-Worship	2.511	1.11	9,865	3816
8004703	The Rock Church	Worship	10.192	2.84	43,230	13669
8004704	Claybar Engineering	Non-Worship	2.501	1.94	11,097	9562
8004726	Quick Fix Tire	Non-Worship	0.547	0.28	2,426	2372
8004741	Earth Company Investors	Non-Worship	1.867	2.19	10,765	15401
8004742	Annabelles Pizza & Pasta	Non-Worship	2.030	1.79	8,207	8572
8004743	Turtle's	Non-Worship	0.860	0.56	3,059	3171
8004744	Fulton's Old Sacramento	Non-Worship	0.373	0.21	2,901	1148
8004745	Riverboat Delta King	Non-Worship	12.716	20.54	62,463	138689
8004746	Fanny Ann's	Non-Worship	3.308	5.29	13,815	32688
8004748	Golf Green Mobile Home Park	Non-Worship	1.692	1.29	6,937	4639
8004749	St John The Evangelist Catholic Church	Worship	18.643	0.04	69,852	24987
8004751	Praise Chapel Fellowship	Worship	3.807	0.31	11,862	3036
8004752	Ram & Ram Associates Inc.	Non-Worship	0.590	0.31	1,962	1025
8004760	Sun Furniture	Non-Worship	3.286	1.65	12,152	5919
8004761	Rancho Tire & Auto dba Goodyear	Non-Worship	1.831	0.83	8,969	3928
8004762	Superior Automotive	Non-Worship	0.756	0.53	4,193	2663
8004763	La Bamba Music	Non-Worship	4.228	1.94	12,313	6868
8004765	Next Time Thrift Store	Non-Worship	18.360	6.61	84,864	57885
8004769	Curves	Non-Worship	0.502	0.21	1,919	879
8004776	Macedonia Baptist Church	Worship	0.373	0.37	2,901	3617
8004777	Bills Gourmet Deli	Non-Worship	1.053	0.87	3,959	4071
8004785	Subway Truck Parts Inc.	Non-Worship	4.199	1.80	17,466	7191
8004793	Ananda	Non-Worship	3.408	2.63	13,127	12282
8004795	Blinds 4 Less	Non-Worship	1.188	0.47	5,272	1985
8004796	Floor Store	Non-Worship	1.054	1.00	3,664	3781
8004803	Fitness Systems	Non-Worship	1.291	1.38	7,685	9831
8004804	Super 8 Motel	Non-Worship	0.331	0.33	2,579	3062
8004805	Goins Realty	Non-Worship	0.392	0.00	1,734	0
8004806	Persian Garden Restaurant	Non-Worship	1.350	1.42	5,506	5483
8004807	Mrs. Fields	Non-Worship	0.685	0.57	2,910	2381
8004808	Mel's The Orginal	Non-Worship	2.511	3.21	14,978	20713
8004809	Lamp's Mart	Non-Worship	14.070	13.30	59,625	43823
8004810	El Camino Baptist Church	Worship	8.023	6.61	38,360	27863
8004829	Made In America	Non-Worship	1.207	1.05	5,579	3803

ID	*Name*	*Type of Business*	*Expected kW*	*Calculated Peak kW*	*Expected Savings (kWh)*	*Calculated Energy Savings (kWh)*
8004834	United Smog Center	Non-Worship	0.657	0.59	3,280	2500
8004835	Sherwin Williams Automotive Finishes	Non-Worship	1.336	2.72	5,556	23865
8004838	Bikers Wear	Non-Worship	1.418	0.27	4,493	704
8004839	J. Crawfords Bookstore	Non-Worship	1.607	0.85	6,653	3470
8004840	Florin Worship Center	Worship	2.390	0.94	10,603	3444
8004841	A-1 Market	Non-Worship	2.284	0.97	8,763	4937
8004842	Pints & Fifths	Non-Worship	0.000	0.71	1,298	4271
8004847	Peak Manufacturing	Non-Worship	2.829	2.02	15,691	9557
8004855	St Andrew's United Methodist Church	Worship	2.966	2.31	22,859	22205
8004861	Ncn District	Worship	6.813	0.44	35,371	1951
8004864	Christian Faith Church	Worship	13.346	4.04	50,245	13077
8004870	Metro Lotto-Liquor	Non-Worship	1.231	1.01	6,374	5209
8004910	Jim Hanley Tire & Auto Service	Non-Worship	1.790	1.93	8,771	16920
8004911	Keyston Bros.	Non-Worship	5.316	3.82	29,484	16882
8004931	California Office Furniture	Non-Worship	1.423	0.85	5,262	3751
8004943	Harry's Liquor And Food	Non-Worship	2.810	2.32	15,195	14719
8004961	Barry Paulsen's Boat Center	Non-Worship	3.916	2.90	19,910	16259

Table A-2. Sites Where Lighting Usage Was Monitored

Site Id	Site Name	Annual Operating Hours	Average Peak Hours
8004208	YMCA Greater Sacramento Area	1,516	2.7
8004285	College Oak Nursing & Rehabilitation	2,447	5.8
8004307	McCreerys Home Furnishings	2,997	6.4
8004360	A New You	2,519	5.8
8004421	Shannons House	2,681	6.0
8004438	DSI -Southgate Clinic	5,358	6.8
8004439	DSI - University Clinic	2,086	4.2
8004440	D and L Furniture	1,812	4.0
8004449	California Party Time Inc.	3,152	7.3
8004451	Heritage Convalescent Nursing Home	5,465	7.0
8004452	Dr. Steven Hammer	1,879	4.1
8004454	Law Enforcement Chaplaincy	1,934	4.7
8004467	Park Sacramento	2,894	5.7
8004473	Ultra Glass	2,757	5.4
8004480	Faith Lutheran Church	1,988	4.4
8004495	T.M.S.	8,760	8.0
8004520	Parkway Church of Christ	1,221	2.4
8004523	Thompson's Funeral Home	2,874	6.1
8004524	Central International	1,711	3.3
8004525	Messiah Lutheran Church	828	0.8
8004527	Launderland	8,760	8.0
8004532	The Carmichael Bible Church	182	0.4
8004534	Presentation Catholic School	1,933	3.7
8004535	The Carmichael Bible Church	758	1.4
8004564	ATV Production Center	2,808	5.8
8004576	YWCA Sacramento	2,994	6.8
8004579	Immanuel Baptist Church	1,950	2.6
8004581	Oak Hills Church	1,549	2.0
8004597	Rosewood Terrace	8,760	8.0
8004636	Correctional Peace Officers Foundation	3,249	7.5
8004659	Carmichael SDA Church	1,932	1.8
8004668	Citrus Heights SDA Church	968	0.9
8004669	Creative Frontiers	3,734	7.8
8004670	Faith Christian Academy	1,454	2.4
8004671	Sylvan Oaks Christian Church	240	0.6
8004675	VFW Post 67	1,121	2.2
8004676	Madison Ave Baptist	2,614	2.8
8004679	Fuqua Physical Therapy	2,240	4.7
8004686	Furniture Source	3,504	7.2
8004688	Appliance Parts Center	2,853	6.4
8004689	Furniture Superstores	3,492	7.0
8004702	Indian Motorcycle	2,366	5.5
8004703	The Rock Church	1,584	2.6
8004704	Claybar Engineering	3,129	5.1
8004726	Quick Fix Tire	8,167	7.7
8004742	AnnaBelles Pizza & Pasta	3,149	5.3

Site Id	Site Name	Annual Operating Hours	Average Peak Hours
8004743	Turtle's	2,473	3.5
8004745	Riverboat Delta King	6,705	7.9
8004746	Fanny Ann's	6,179	8.0
8004748	Golf Green Mobile Home Park	1,986	4.4
8004749	St John The Evangelist Catholic Church	1,342	0.0
8004751	Praise Chapel Fellowship	938	0.8
8004752	Ram & Ram Associates Inc.	1,980	4.8
8004760	Sun Furniture	2,939	6.5
8004761	Rancho Tire & Auto dBA Goodyear	2,774	4.7
8004762	Superior Automotive	2,482	3.9
8004763	La Bamba Music	3,541	8.0
8004765	Next Time Thrift Store	8,760	8.0
8004769	Curves	2,224	4.2
8004785	Subway Truck Parts Inc.	2,305	4.6
8004793	ANANDA	3,003	5.1
8004795	Blinds 4 Less	3,495	6.6
8004796	Floor Store	2,954	6.3
8004806	Persian Garden Restaurant	3,393	7.0
8004807	Mrs. Fields	4,193	8.0
8004808	Mel's The Orginal	6,457	8.0
8004809	Lamp's Mart	3,295	8.0
8004810	El Camino Baptist Church	2,596	4.9
8004829	Made in America	2,990	6.6
8004834	United Smog Center	2,681	5.0
8004835	Sherwin Williams Automotive Finishes	8,760	8.0
8004838	Bikers Wear	1,855	5.6
8004839	J. Crawfords Bookstore	3,103	6.1
8004840	Florin Worship Center	2,402	5.3
8004841	A-1 Market	5,105	8.0
8004842	Pints & Fifths	6,002	8.0
8004847	Peak Manufacturing	2,931	4.9
8004861	NCN District	3,029	5.5
8004864	Christian Faith Church	1,572	3.9
8004870	Metro Lotto-Liquor	5,168	8.0
8004910	Jim Hanley Tire & Auto Service	8,760	8.0
8004911	Keyston Bros.	2,673	4.8
8004931	California Office Furniture	2,589	4.7
8004943	Harry's Liquor and Food	6,339	8.0
8004961	Barry Paulsen's Boat Center	3,793	5.4

Table A-3. Sites Where Lighting Level Measurements Were Taken

Site ID	*Site Name*	*Net Change (foot-candles)*
8004208	YMCA Greater Sacramento Area	-27.44
8004360	A New You	23.01
8004409	Gloria Dei Lutheran Church & School	-9.22
8004438	DSI -Southgate Clinic	10.33
8004439	DSI - University Clinic	24.67
8004449	California Party Time Inc.	13.78
8004451	Heritage Convalescent Nursing Home	14.89
8004452	Dr. Steven Hammer	4.40
8004454	Law Enforcement Chaplaincy	27.57
8004473	Ultra Glass	15.67
8004480	Faith Lutheran Church	26.11
8004495	T.M.S.	-20.72
8004520	Parkway Church of Christ	-0.33
8004524	Central International	4.78
8004525	Messiah Lutheran Church	-15.11
8004527	Launderland	30.89
8004532	The Carmichael Bible Church	-0.89
8004534	Presentation Catholic School	-28.33
8004535	The Carmichael Bible Church	30.89
8004564	ATV Production Center	19.77
8004576	YWCA Sacramento	0.22
8004577	Sacramento Homng Alliance Church	-1.06
8004581	Oak Hills Church	0.44
8004597	Rosewood Terrace	12.89
8004636	Correctional Peace Officers Foundation	-12.44
8004658	Creekside Pet Resort	-2.02
8004659	Carmichael SDA Church	6.27
8004668	Citrus Heights SDA Church	-4.48
8004669	Creative Frontiers	43.51
8004670	Faith Christian Academy	13.56
8004671	Sylvan Oaks Christian Church	0.25
8004674	India Market	0.00
8004675	VFW Post 67	8.00
8004679	Fuqua Physical Therapy	33.16
8004686	Furniture Source	-22.44
8004688	Appliance Parts Center	9.44
8004702	Indian Motorcycle	10.25
8004703	The Rock Church	28.69
8004704	Claybar Engineering	22.42
8004726	Quick Fix Tire	-7.00
8004748	Golf Green Mobile Home Park	-3.44
8004749	St John The Evangelist Catholic Church	-3.22
8004751	Praise Chapel Fellowship	22.56
8004752	Ram & Ram Associates Inc.	30.44
8004760	Sun Furniture	-13.78
8004761	Rancho Tire & Auto dba Goodyear	-5.89

Site ID	Site Name	Net Change (foot-candles)
8004762	Superior Automotive	8.33
8004763	La Bamba Music	18.67
8004765	Next Time Thrift Store	4.00
8004769	Curves	13.22
8004777	Bills Gourmet Deli	-45.99
8004785	Subway Truck Parts Inc.	5.33
8004796	Floor Store	22.90
8004810	El Camino Baptist Church	76.94
8004829	Made in America	36.64
8004834	United Smog Center	58.44
8004835	Sherwin Williams Automotive Finishes	3.82
8004838	Bikers Wear	16.98
8004839	J. Crawfords Bookstore	14.49
8004840	Florin Worship Center	19.58
8004841	A-1 Market	26.00
8004842	Pints & Fifths	25.00
8004847	Peak Manufacturing	17.63
8004864	Christian Faith Church	9.10
8004910	Jim Hanley Tire & Auto Service	44.09
8004931	California Office Furniture	-0.44
8004943	Harry's Liquor And Food	20.78
8004961	Barry Paulsen's Boat Center	-15.00
8004360	A New You	19.13
8004480	Faith Lutheran Church	27.00
8004495	T.M.S.	9.08
8004520	Parkway Church of Christ	9.33
8004524	Central International	4.33
8004525	Messiah Lutheran Church	0.00
8004564	ATV Production Center	19.17
8004636	Correctional Peace Officers Foundation	4.11
8004658	Creekside Pet Resort	-11.00
8004668	Citrus Heights SDA Church	10.98
8004674	India Market	0.00
8004675	VFW Post 67	18.03
8004679	Fuqua Physical Therapy	15.42
8004702	Indian Motorcycle	11.46
8004703	The Rock Church	15.71
8004704	Claybar Engineering	11.36
8004748	Golf Green Mobile Home Park	10.89
8004749	St John The Evangelist Catholic Church	8.11
8004762	Superior Automotive	54.67
8004777	Bills Gourmet Deli	-18.72
8004796	Floor Store	8.33
8004834	United Smog Center	-5.53
8004835	Sherwin Williams Automotive Finishes	7.84
8004840	Florin Worship Center	28.72
8004842	Pints & Fifths	12.72

Site ID	*Site Name*	*Net Change (foot-candles)*
8004847	Peak Manufacturing	11.77
8004855	St Andrew's United Methodist Church	44.09
8004864	Christian Faith Church	-6.96
8004910	Jim Hanley Tire & Auto Service	14.85
8004523	Thompson's Funeral Home	22.54
8004564	ATV Production Center	6.72
8004636	Correctional Peace Officers Foundation	-21.22
8004674	India Market	0.00
8004679	Fuqua Physical Therapy	14.18
8004702	Indian Motorcycle	-3.67
8004703	The Rock Church	2.36
8004835	Sherwin Williams Automotive Finishes	7.44
8004864	Christian Faith Church	-29.51
8004910	Jim Hanley Tire & Auto Service	33.66

Table A-4. Sites Where Clamp On Power Measurements Were Taken

Site ID	Site Name
8004208	YMCA Greater Sacramento Area
8004285	College Oak Nursing & Rehabilitation
8004409	Gloria Dei Lutheran Church & School
8004438	DSI -Southgate Clinic
8004439	DSI - University Clinic
8004449	California Party Time Inc.
8004451	Heritage Convalescent Nursing Home
8004452	Dr. Steven Hammer
8004473	Ultra Glass
8004495	T.M.S.
8004520	Parkway Church of Christ
8004524	Central International
8004525	Messiah Lutheran Church
8004527	Launderland
8004532	The Carmichael Bible Church
8004534	Presentation Catholic School
8004535	The Carmichael Bible Church
8004576	YWCA Sacramento
8004577	Sacramento Homng Alliance Church
8004581	Oak Hills Church
8004597	Rosewood Terrace
8004636	Correctional Peace Officers Foundation
8004670	Faith Christian Academy
8004688	Appliance Parts Center
8004689	Furniture Superstores
8004748	Golf Green Mobile Home Park
8004751	Praise Chapel Fellowship
8004761	Rancho Tire & Auto DBA Goodyear
8004762	Superior Automotive
8004763	La Bamba Music
8004769	Curves
8004911	Keyston Bros.
8004931	California Office Furniture
8004961	Barry Paulsen's Boat Center
8004452	Dr. Steven Hammer
8004480	Faith Lutheran Church
8004495	T.M.S.
8004520	Parkway Church Of Christ
8004524	Central International
8004525	Messiah Lutheran Church
8004636	Correctional Peace Officers Foundation
8004748	Golf Green Mobile Home Park
8004749	St John The Evangelist Catholic Church

Appendix B
On-Site Data Collection Form

Appendix C
Telephone Survey Instrument