*San Diego Gas & Electric*
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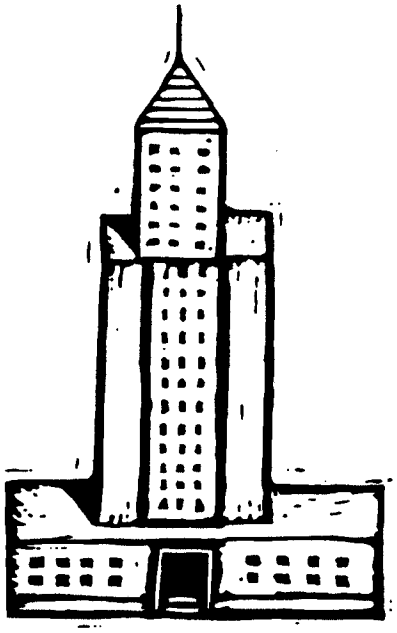
# *1996 Commercial Energy Efficiency Incentives Program*

## *First Year Load Impact Evaluation*

***March 1998***



Study ID No.992

# Table of Contents

# Section 1
# Executive Summary

This is an evaluation of the Program Year 1996 (PY96) first year load impacts for SDG&E's commercial customers, who are a subset of the nonresidential customers who participated in SDG&E's Commercial/Industrial/ Agricultural (C/I/A) Energy Efficiency Incentives (EEI) Programs. The C/I/A EEI Programs help customers reduce energy costs and increase energy efficiency at their facilities. There are two major end uses covered by this report: (1) indoor lighting and (2) space cooling (HVAC). The total number of CEEI Program participants with these end uses are shown below:

**Table 1**
**Number of Commercial Customers**

| End Use | Sector | Number of Participants |
|---|---|---|
| Lighting | Nonmilitary | 4,555 |
| | Military | 23 |
| | **Total** | **4,578** |
| HVAC | Nonmilitary | 128 |
| | Military | 0 |
| | **Total** | **128** |

SDG&E obtained a retroactive waiver (see Appendix A) to the "Protocols and Procedures for Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs" (M&E Protocols) for evaluating the energy efficiency measures installed by military customers. This waiver allows for the evaluation of all measures installed in military bases under M&E Protocols Table C-5, instead of Table C-4. This allows the use of engineering estimates with *ex post* verification of the assumptions in the engineering model. SDG&E contracted with XENERGY, Inc. to conduct the military study, which is provided in Section 4 of this report.

Load Impact Regression Models were used to determine the load impacts for lighting and HVAC for nonmilitary commercial participants.

The PY96 CEEI Program study results, shown in the designated unit of measurement (DUOM), each end use are as follows:

**Table 2**
**Study Results of CEEI Programs**

| End Use | Study Group | Energy Savings[1] (kWh) | Realization Rate[2] | Demand Savings[1] (kW) | Realization Rate | Net-to-Gross Ratio |
|---|---|---|---|---|---|---|
| Lighting | Nonmilitary | 0.0556 | 1.045 | .0478 | 0.921 | 0.802 |
| | Military | 0.2574 | 1.061 | 0.2054 | 0.857 | 1.000 |
| HVAC | Nonmilitary | 0.6892 | 1.012 | 0.0003 | 822.6 | 1.460 |
| | Military | 0 | 0 | 0 | 0 | 0 |

[1] Lighting DUOM: load impact per square foot per 1,000 hours of operation
HVAC DUOM: load impact per square foot

[2] The Realization Rate is defined at the end use level as the load impacts estimated by the study, divided by the utility's first year earnings claim.

## Organization of Report

The report is organized into several sections.

**Section 2 - Study Overview:** This section presents the program description and a discussion of the participant database, nonparticipant group, and data collection efforts.

**Section 3 - Nonmilitary Lighting & HVAC Studies:** This section discusses the regression models and results obtained for the first year load impact study for nonmilitary lighting and HVAC.

**Section 4 - Military Sector Study by XENERGY:** This section contains the first year load impact study conducted by XENERGY on the military bases.

**Appendices:** This section contains all the appendices referenced throughout the report, and the M&E Protocols Reporting Requirements Tables 6 and 7 for the various end uses.

# Section 2
# Study Overview

**Program Description**

San Diego Gas & Electric offers the Commercial/Industrial/Agricultural (C/I/A) Energy Efficiency Incentives (EEI) Programs to help customers reduce energy costs and increase energy efficiency at their facilities. The C/I/A EEI Programs, supported through audit programs, energy services representatives, and account executives, provide cost-effective DSM energy savings when existing customers have retrofit opportunities. SDG&E has three main market delivery mechanisms for providing incentives for retrofit or replace-on-burnout applications: (1) Commercial/Industrial (C/I) Incentives Program, (2) Power to Save Program, and (3) Commercial Rebates Program. Through this marketing strategy, SDG&E is provided the flexibility needed to encourage the adoption of energy efficient measures that would not otherwise be installed by customers due to economic market barriers.

**C/I Incentives**. This program typically targets large customers where SDG&E's account executives are involved in assisting customers with major retrofit applications. This program offers incentives to customers for the installation of standard mechanical and complex custom energy efficient measures. Energy efficient measures that have been identified as cost-effective when applied to specific building types are categorized as standard measures. Incentives are also available for measures on a customized basis, providing the project meets the program cost-effectiveness tests.

Energy savings are determined and reviewed by SDG&E's engineering staff. Additionally, for further verification, an outside consulting engineering firm performs semi-annual reviews of the completed job files.

**Power to Save**. This marketing strategy offers incentives to customers for the installation of energy efficient lighting and mechanical technologies. This full service strategy focuses on standard and custom lighting applications, as well as less complex standard and custom mechanical applications for all sizes of commercial and industrial customers, but tends to accommodate medium/small commercial/industrial customers.

Customer participation begins with an energy audit and recommendations for energy efficient equipment based on audit results. Customers are encouraged to participate in this program by installing cost-effective energy efficient measures and receiving incentives for those measures.

**Commercial Rebates**. These rebates are delivered through retailers/wholesalers who give the commercial/industrial/agricultural customer an instant incentive at the point of purchase. This program offers rebates to these customers for the following measures: (1) high efficiency refrigerators, (2) compact fluorescent lamps, (3) other energy efficient lighting technologies, (4) energy efficient motors, and (5) HVAC measures.

## Sampling & Data Collection for the Lighting and HVAC End Uses

This section describes only the nonmilitary sector of SDG&E's Commercial EEI Program. A thorough discussion of the military section is contained in Section 4 on Military Installations by XENERGY.

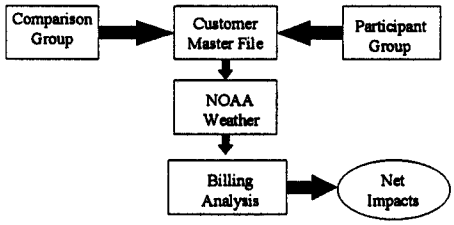
### Data Collection

Data for the impact analysis were obtained from the following major sources:

- Customer name, address, affected square footage, lighting hours of operation, and installation date from the program tracking database;
- Comparison group (nonparticipants) was selected from the Customer Master File after the participants were determined;
- Consumption history from the Customer Master File;
- Data on floor stock, square footage, hours of operation, installation of energy efficient equipment, and occupancy from on-site audits for the nonparticipant group;
- Hourly weather data from NOAA files for the SDG&E climate zones: Maritime, Coastal and Transitional.

The following diagram describes the flow of data into the final new impact results:

Data Flow Diagram



**Participant Database**

A total of 4,683 commercial customers (excluding the military bases) were identified in the 1996 commercial database for the lighting and HVAC load impact studies. An attempt was made to include all participants who were identified to have only indoor lighting or only HVAC installations in the analysis.

Participants used in the study are broken down by end use as follows:

**Table 3**
**Study Participants by End Use**

| | |
|---|---|
| Commercial Indoor Lighting Only | 4,555 |
| Commercial HVAC Only | 128 |

**Nonparticipant Sample**

The M&E Protocols require a nonparticipant sample for the evaluation of the Commercial EEI Programs under Table C-4. The nonparticipant sample was developed from SDG&E's Customer Master File by obtaining a list of commercial customers and their associated unique Premise ID numbers (generally a unique customer address). This nonparticipant group was determined not to have participated in any of the 1996 DSM nonresidential programs. For the purpose of selecting the nonparticipant sample, the participants were grouped by annual kWh and the ten building types defined by the CEC. The comparison group was then stratified by the same building types and consumption levels in order to match them to the participant group. Three hundred fifty customers were selected as the sample. Replacements were selected if a sample point could not be surveyed. This group was intended to serve as the comparison group for both the lighting and HVAC studies.

A summary of the participant group and the nonparticipant sampling frame by building type and size is given below. Note that a small building's consumption is less than 10,000 kWh per year; a medium building's consumption is 10,000 to 40,000 kWh; and a large building's consumption is greater than 40,000 kWh per year.

**Table 4**
**Commercial Customers By Study Groups**

| | Small | | Medium | | Large | |
|---|---|---|---|---|---|---|
| Segment | Participant | Nonparticipant | Participant | Nonparticipant | Participant | Nonparticipant |
| College | 18 | 311 | 9 | 29 | 13 | 27 |
| Grocery | 22 | 1,405 | 26 | 418 | 38 | 106 |
| Hospital | 5 | 141 | 3 | 36 | 23 | 24 |
| Lodging | 112 | 377 | 130 | 110 | 81 | 30 |
| Nursing Homes | 6 | 48 | 26 | 11 | 23 | 7 |
| Restaurant | 337 | 4,135 | 217 | 705 | 26 | 60 |
| School | 68 | 662 | 45 | 221 | 25 | 64 |
| Retail | 286 | 8,239 | 107 | 929 | 44 | 219 |
| Offices | 873 | 22,957 | 274 | 1074 | 191 | 255 |
| Com'l Bldg | 808 | 15,388 | 207 | 644 | 111 | 166 |
| Other Com'l | 23 | 5,992 | 7 | 181 | 23 | 99 |
| Other | 3 | 13,495 | 2 | 274 | 0 | 56 |
| **Total** | **2,561** | **73,150** | **1,053** | **4,632** | **5,98** | **1,113** |

***On Site Audits of Nonparticipants***

VIEWtech conducted the on-site surveys of the nonparticipant sample for SDG&E. Detailed on-site audits were conducted on 350 sites. The primary purpose of the audits was to collect information on floor stock, lighted and conditioned square footage, hours of operation, occupancy, and information on any energy efficiency installations the customer may have done including the date of installation. A copy of the survey instrument and the building type breakdown of the sample is provided in Appendix C.

**Billing and Weather Data**

Hourly weather data were estimated from daily highs and lows from NOAA data files and converted to heating and cooling degreehours (with a base of 65 degrees Fahrenheit). These were matched to consumption data from the Customer Master File by billing cycle and climate zone for each household.

Long-term averages for cooling degree hours are used for weather-normalization purposes in the regression models. These are the average cooling degree hours covering a period of 12 years dating back to December 1985 through November 1997.

The following are special cases eliminated in the analysis:

1. Participants who also participated in the New Construction Program were eliminated from the analysis.
2. Multifamily complexes were also eliminated due to the difficulty (due to name variations and multi-address sites) in identifying all the electric meters associated with the complex.
3. Participants who subscribed to the commercial programs both as an individual customer and as part of a multi-customer contract (e.g., chain stores, branches of corporate customers) were eliminated. Savings in multi-customer contracts are not disaggregated by individual customer. This multi-customer contract savings aggregation makes it difficult to estimate the individual contract savings without double counting the savings from the multi-customer contracts.

For each customer in the participant and comparison groups, consumption data and weather data gathered for use in the analysis covered the period beginning January 1995 through November 1997. Each customer's consumption and weather data were further screened to meet the M&E Protocols data requirement of twelve months pre-installation and nine months post-installation data. Customers that did not meet this data requirement were eliminated from the analysis. Table 5 illustrates data attrition for the participant group and the nonparticipant group.

**Table 5**
**Study Group Pre-Regression Attrition**

| | Lighting | | HVAC | |
|---|---|---|---|---|
| Status | Participants | Nonparticipants | Participants | Nonparticipants |
| Starting Study Group | 4,555 | 350 | 128 | 350 |
| Special Cases Eliminated | 3,521 | NA | 70 | NA |
| Billing Data Available | 3,521 | 350 | 64 | 350 |
| Sufficient Pre/Post Data | 3,216 | 319 | 60 | 319 |

## Discussion of Measurement & Evaluation Issues

### Revision of the Earnings Table E-3

As part of the *ex post* evaluation, some measures were reclassified under other end uses. Some participants were also recategorized from Commercial to Industrial or vice versa upon verification of the assigned SIC code. This provides consistency between the PY96 First Earnings Claim and the first year load impact evaluations for the purpose of calculating the realization rates for each end use, and subsequently completing Table E-3 for the PY96 Second Earnings Claim. The revised Table E-3 is attached as Appendix C of this report. The table will also be included in the SDG&E 1998 AEAP application.

### Incorporation of the Nonmilitary and Military Load Impacts for Table E-3

The results from the XENERGY study were used to modify the load impacts for the lighting end use installed by the military participants. The study results from the Indoor Lighting and HVAC Studies section were used to modify the load impacts for the lighting and HVAC end uses installed by the nonmilitary participants. The total load impact parameter for the entire commercial group is then the weighted sum of the study group load impacts. Weights for each parameter (energy and demand) were determined by the contribution of each study group (military and nonmilitary) to the total value of each parameter. The following table shows the weights for each parameter by end use and study group.

**Table 6**
**Load Impact Weights by Study Group**

| | | Nonmilitary | | Military | |
|---|---|---|---|---|---|
| Parameter | | Lighting | HVAC | Lighting | HVAC |
| Energy Load Impact (kWh) | Gross | 0.8814 | 1.0000 | 0.1186 | 0.0000 |
| Demand Load Impact (kW) | Gross | 0.8475 | 1.0000 | 0.1525 | 0.0000 |

### Commercial Miscellaneous End Use

The 15% cap of total net resource benefits (modified by the net-to-gross ratio) for miscellaneous measures for this program was not exceeded. Therefore, no additional load impact studies other than the required end uses, indoor lighting and HVAC, were conducted for the CEEI Program.

# Section 3
# Nonmilitary Lighting and HVAC Studies
# The General Model

**The Individual Elements of the General Model**

For customer i and month t, the general regression model is,

**Equation 1 (The General Structure of the Regression Equation)**

$$kWh_{it} = X_{it} + W_{it} + S_{it} + e_{it}$$

The dependent variable $kWh_{it}$ is the monthly energy consumption for customer i, normalized for the length of the billing cycle. A constant and a simple trend term make up the non-weather/non-DSM portion of the regression equation:

**Equation 2 (The Non-Weather/Non-DSM Portion of the Regression Equation)**

$$X_{it} = \beta_{0i} + \beta_{1i}(t)$$

Cooling degreehours make up the weather-sensitive portion of the model:

**Equation 3 (The Weather Portion of the Regression Equation)**

$$W_{it} = \beta_{2i}(cdh_{it})$$

The cooling degreehour variable is the sum of the cooling degrees for the corresponding normalized billing month.

For customer i, DSM contract j is associated with the weather-normalized *ex ante* estimate of monthly energy savings $F_{ij}$. The statistical estimate for monthly savings $S_{ijt}$ is,

**Equation 4 (The DSM Portion of the Model)**

$$S_{it} = \sum_{j} S_{ijt}$$

$$S_{ijt} = (\gamma_{1ij} + \gamma_{2ij} cdh_{it}) d_{ijt} F_{ij}$$

The term, $(\gamma_{1ij} + \gamma_{2ij} cdh_{it})$ is the estimated realization rate for contract j, generated in the regression by the indicator variable depending on the date of DSM installation.

# The Lighting Regression Model

For the lighting model, the cooling-degreehour variable is suppressed, so that $\gamma_{2ij} = 0$. We assume that the realization rate is constant across contracts (within customers): $\gamma_{1ij} = \gamma_{1i}$. After a rearrangement of terms,

$$S_{it} = \gamma_{1i} \sum_j d_{ijt} F_{ij}$$

A final transformation of the DSM portion of the model will allow us to maintain consistency between the participant regression results and the nonparticipant regression results. We define the scaled *ex ante* estimate $F_{ij}^*$,

**Equation 5 (Normalizing the *Ex Ante* Estimes and Finding the Maximum of *Ex Ante* Savings)**

$$F_{ij}^* = \frac{F_{ij}}{k_i}, \quad k_i = \max_t \sum_j d_{ijt} F_{ij}$$

**Equation 6 (The Transformed DSM Portion of the Regression Model)**

$$S_{it} = \gamma_{1i} k_i \sum_j d_{ijt} F_{ij}^*$$

When a single customer has only a single contract, it follows that $F_{ij}^* = 1$, and the model degenerates into a fairly simple model based on a straightforward zero-one indicator variable. However, the real importance of this last transformation stems from the fact that the regression coefficient $\gamma_{1i} k_i$ is in units of monthly kWh. This allows for consistency when we move on to the nonparticipant model where there are no *ex ante* estimates of savings.

**Final Regression Components with Transformed Variables**

Further linear transformations of the regressors in the model gives,

**Equation 7 (The Transformed Non-Weather/Non-DSM Portion of the Lighting Regression Equation)**

$$X_{it} = \beta_{0i}^* + \beta_{1i}(t - t^*)$$

**Equation 8 (The Transformed Weather Portion of the Lighting Regression Equation)**

$$W_{it} = \beta_{2i}\left(\frac{cdh_{it}}{\overline{cdh}_i} - 1\right)$$

where $\beta_{0i}^{*}$ is the new intercept determined by the various transformations. Clearly, $\beta_{0i}^{*}$ can be interpreted as the weather-normalized value for monthly kWh consumption, prior to the DSM installation, evaluated along the trend at month $t^{*}$ (in this case, taken to last possible month in the data sample: December 1997).

**Derivation of the Designated Unit of Measurement (DUOM) from the Lighting Gross-Impact Regression Model**

The key regression result will be the single regression coefficient $\gamma_{1i}k_i$, generated by the regressor $\sum_j d_{ijt}F_{ij}^{*}$. This coefficient represents the estimated monthly kWh load impact. As a result, the load impact, per square foot, per thousand hours of operation is,

**Equation 9 (The Designated Unit of Measurement for Lighting Participants)**

$$DUOM_{lighting}^{part} = \frac{(12\text{months})\times(1{,}000\text{hours})\sum_{i\in part}\gamma_{1i}k_i}{\left(\overline{hours}^{part}\right)\sum_{i\in part}sqft_i}$$

The sample-wide realization rate for the *ex ante* energy estimates can also be calculated:

$$\rho = \frac{\sum_{i\in part}\gamma_{1i}k_i}{\sum_{i\in part}k_i}$$

**The Lighting Impact Regression for Nonparticipants**

Among nonparticipants who have installed lighting measures, data is not available for obtaining *ex ante* estimates. In addition, no multiple DSM lighting installations existed within the sample of nonparticipants. As a result, for the DSM portion of the nonparticipant lighting model, $\sum_j d_{ijt}F_{ij}^{*} = d_{it}$, so that,

$$X_{it} = \beta_{0i}^{*} + \beta_{1i}(t - t^{*})$$

$$W_{it} = \beta_{2i}\left(\frac{cdh_{it}}{\overline{cdh}_i} - 1\right)$$

**Equation 10 (The DSM portion of the nonparticipant lighting model)**

$$S_{it} = \gamma_{1i}k_i(d_{it})$$

With respect to nonparticipants, there is a major question concerning the role of the regressor $d_{it}$. When survey results indicated that a nonparticipant had undertaken a lighting retrofit job, the structure of $d_{it}$ is naturally that of a standard zero-one indicator variable. However, when there is no retrofit, the natural step—in keeping the participant and nonparticipant models parallel—would be to impose the constraint $\gamma_{1i}k_i = 0$, while keeping data on square footage and hours of operation within the analysis. However, it is important to deal with nonlighting events, such as broad based changes in economic activity, political, and social phenomena, or any discrete events not accounted for in the model which are coincident with the retrofit, and, as such, affect the gross impact model. Estimating the impact of these effects is part of adjusting the gross impact and, eventually, deriving estimates of net impact. The nonparticipant model can assist us in this estimation task, provided that the variable $d_{it}$ is specified accordingly. As a result, when a nonparticipant in the database had not undertaken a lighting retrofit, $d_{it}$ and the associated regressor $\gamma_{1i}k_i$ were maintained in the model, with $d_{it}$ associated with an average installation date among participants. This average installation date was determined to be August 1996 (for both lighting and HVAC).

**Derivation of the Designated Unit of Measurement (DUOM) for Nonparticipants**

Based on the previous section, results are available for nonparticipants that parallel those of Equation 9:

**Equation 11 (The Designated Unit of Measurement for Lighting Nonparticipants)**

$$DUOM_{lighting}^{nonpart} = \frac{(12\text{months}) \times (1{,}000\text{hours}) \sum_{i \in nonpart} \gamma_{1i} k_i}{\left(\overline{hours}^{nonpart}\right) \sum_{i \in nonpart} sqft_i}$$

**Estimation**

**Data**

The billing data for participants and nonparticipants were checked for kWh data that were missing or were most likely inconsistent with the specification for the regression equation. When these data were eliminated and the resulting data allowed for 12 months of pre-installation data and 9 months of post-installation data, the customer was included in the analysis (3,216 and 319 customers, for participants and nonparticipants, respectively). In addition, a portion of the sample (479 and 51, for participants and nonparticipants, respectively) did not satisfy a root-mean-squared-error (RMSE) criterion, explained in the next section.

**Estimation Methods**

The model specified in Equation 1, and Equation 6-Equation 8 was estimated at the customer level for participants. To add some flexibility to the model, as was done in previous year's models, the month for the retrofit, and the month just after this point, were weighted out of the regression. In addition, both a trended model ($X_{it} = \beta^*_{0i} + \beta_{1i}(t - t^*)$, in Equation 7) and a nontrended model ($X_{it} = \beta^*_{0i}$, in Equation 7) were estimated. When the absolute value of the t-statistic for the trended term (in the trended model) was less than two, the trended results were rejected in favor of the nontrended results.

Once the regressions were completed, an additional filter--the RMSE criterion--was applied, as was done in last year's study. Within the broad and complicated setting of commercial and industrial energy consumption, a fairly simple tool like regression analysis will not perform with uniform success; a fraction of the regressions simply will not "work"; that is, the specified model will not be a reasonable approximation to reality. As a result, a reasonable and systematic criterion must be put in place for which there is a high probability of omitting unreasonable regression results. Along these lines, a ratio was calculated for each customer by dividing the root-mean-squared error for the regression by the intercept $\beta^*_{0i}$. This ratio is very likely to be large when the regression simply fails, since inadequacies in the specification of the model for a particular customer will result in excessively large estimated regression errors. Within the analysis, regressions were omitted where this ratio was greater than 15%.

**Modifying Square Footage Estimates**

Simple visual inspection of the billing data and the *ex ante* savings estimates proves that, in a subset of lighting-retrofit cases, assigning the correct monthly billing data to the retrofit job is a definite problem. In particular, in some cases, the *ex ante* estimates are much too large relative to kWh consumption, to the point where we must conclude that the premise-identification data (which cause us to assign certain billing data to a retrofit job) are in error. This is a problem which tends to bias the aggregate savings estimate in the direction of zero, since, in such cases, erroneous billing data (the dependent variable in a particular regression) are unassociated with the DSM installations modeled within the set of independent variables. SDG&E has struggled with this problem for some time. Efforts to improve premise-identification data have born little fruit, given the inherent difficulty of analyzing each of thousands of lighting retrofit jobs on this issue.

One method of reducing the bias would be to eliminate the questionable cases from the overall analysis; however, here judgment would most likely play too large a role. SDG&E has selected an alternative approach which relies less on judgment, and is most likely a conservative method of reducing the bias. The approach keeps all such cases in the analysis; this implies that the aggregate savings estimate will still be biased, as will be the estimated realization rate based on the *ex ante* estimates for savings. However, to reduce the bias in calculating the estimated designated unit of measurement, the approach exploits a relationship that is likely to exist between the *ex ante*

savings estimate ($k_i$ in Equation 5) and the true intercept in the regression, which represents the normalized level for consumption ($\beta^*_{0i}$ in Equation 7). It is very likely that savings are bounded by some percentage $\alpha$ of normalized consumption: $k_i < \alpha \times \beta^*_{0i}$. SDG&E's 1994 Market Segment End Use Report (September 1995) indicates that this inequality almost certainly applies for $\alpha = 30\%$. As a result, SDG&E has reduced square footage estimates for some participants using the following factor:

$$sqft_i^{modified} = \min\left[1, \left(\frac{0.30}{k_i/\beta^*_{0,i}}\right)\right] sqft_i$$

With $\alpha = 30\%$, the data for lighting participants yielded an overall adjustment to square footage of 92%:

$$\frac{\sum_i sqft_i^{modified}}{\sum_i sqft_i} = 92\%$$

The modified square-footage estimate was employed in the final calculation of the designated unit of measurement (Equation 11).

## Lighting Load Impact Results

Table 7 summarizes estimated lighting energy load impacts based on the participant and nonparticipant model.

**Table 7**
**Lighting Energy Load Impact Estimates--Participants and Nonparticipants**

| **Participants** | | | |
|---|---|---|---|
| | RMSE | | |
| | Satisfies RMSE Criterion | Does Not Satisfy RMSE Criterion | Grand Total |
| Total Estimated Impact (kWh per month) | -3,977,127 | 762,053 | -3,215,074 |
| Variance of Estimate | 72,052,097,276 | 18,638,827,356 | 90,690,924,631 |
| Total *Ex Ante* Estimate (kWh per month) | 3,353,309 | 642,110 | 3,995,419 |
| Modified Square Footage | 151,080,511 | 20,724,010 | 171,804,520 |
| Sample Size | 2,737 | 479 | 3,216 |
| Average Hours of Operation | 5,692 | | |
| Estimated Designated Unit of Measurement | -0.0555 | | |
| | | | |
| Realization Rate Based on *Ex Ante* Estimates[3] | -118.6% | | |
| **Nonparticipants** | | | |
| | RMSE | | |
| | Satisfies RMSE Criterion | Does Not Satisfy RMSE Criterion | Grand Total |
| Total Estimated Impact (kWh per month) | -32,479 | 56,387 | 23,907 |
| Variance of Estimate | 1,851,451,695 | 1,050,024,599 | 2,901,476,294 |
| Total Lighted Square Footage | 5,607,613 | 723,543 | 6,331,156 |
| Sample Size | 268 | 51 | 319 |
| Average Hours of Operation | 6,337 | | |
| Estimated Designated Unit of Measurement | -0.01097 | | |
| | | | |
| Estimated Net-to-Gross Ratio | 80.2% | | |

[3] The realization rate is defined as the sample ex post total estimated impacts to the sample ex ante total impacts.

**Lighting Demand Load Impact Estimates**

The lighting gross demand estimate was derived using the gross energy estimate from the regression analysis adjusted by the system coincident peak load factor obtained from the 1996 Load Research lighting end use recorder data. This system coincident peak load factor is defined as the ratio of the average demand (or the total annual energy consumption divided by 8760 hours) and the system coincident peak demand for the lighting end use. The system coincident peak load factor for commercial lighting was determined to be 0.75491. The estimated gross demand savings is estimated by Equation 12:

**Equation 12 (Estimated Participant Demand Savings)**

$$\text{Est.Total Demand Savings} = \frac{(3{,}977{,}127\,\text{kWh}) * 12}{8760\ \text{hours} * 0.75491} = 7216.91\,\text{kW}$$

$$\text{Demand Savings (DUOM)} = \frac{1000 * 7216.91\,\text{kW}}{151{,}080{,}511\ \text{sq.ft}} = 0.04778\,\text{kW per square foot}$$

with a realization rate of 92.1%.

**Equation 13 (Estimated Nonparticipant Demand Savings)**

$$\text{Est. Total Demand Savings} = \frac{(32{,}479\,\text{kWh}) * 12}{8760\ \text{hours} * 0.075491} = 58.94\,\text{kW}$$

$$\text{Demand Savings (DUOM)} = \frac{1000 * 58.94\,\text{kW}}{5{,}607{,}613\ \text{sq.ft}} = 0.19097\,\text{kW per square foot}$$

Therefore, the average net impact is 0.03726 kW with a net-to-gross ratio of 85.5%.

# The Space Cooling Regression Model

For space cooling, taking the model in Equation 1-Equation 4, and imposing the same sort of transformations that were imposed in the case of lighting gives,

**Equation 14 (The Transformed Non-Weather/Non-DSM Portion of the Space Cooling Regression Equation)**

$$X_{it} = \beta^{*}_{0i} + \beta_{1i}(t - t^{*})$$

**Equation 15 (The Transformed Weather Portion of the Space Cooling Regression Equation)**

$$W_{it} = \beta_{2i}\left(\frac{cdh_{it}}{\overline{cdh_i}} - 1\right)$$

**Equation 16 (The Transformed DSM Portion of the Space Cooling Regression Model)**

$$S_{it} = \left\{\gamma_{1i} + \gamma_{2i}\left(\overline{cdh_i}\right)\right\}k_i\left(\sum_j d_{ijt}F^{*}_{ij}\right) + \left\{\gamma_{2i}\left(\overline{cdh_i}\right)k_i\right\}\left(\frac{cdh_{it}}{\overline{cdh_i}} - 1\right)\left(\sum_j d_{ijt}F^{*}_{ij}\right)$$

For deriving the DUOM for space cooling,

**Equation 17 (The Designated Unit of Measurement for Space Cooling Participants)**

$$DUOM^{part}_{cooling} = \frac{(12\text{ months}) \times \sum_{i \in part}\left\{\gamma_{1i} + \gamma_{2i}\left(\overline{cdh_i}\right)\right\}k_i}{\sum_{i \in part} sqft_i}$$

The same expression can be estimated for nonparticipants.

**Equation 18 (The Designated Unit of Measurement for Space Cooling Nonparticipants)**

$$DUOM^{nonpart}_{cooling} = \frac{(12\text{ months}) \times \sum_{i \in nonpart}\left\{\gamma_{1i} + \gamma_{2i}\left(\overline{cdh_i}\right)\right\}k_i}{\sum_{i \in nonpart} sqft_i}$$

**Estimation**

The model specified in Equation 14-Equation 16 was estimated at the customer level for participants (in the trended and nontrended form, as in the lighting case). Once the regressions were completed and the t-statistics evaluated, the RMSE criterion was applied. (One additional participant was eliminated who absolutely dominated the participant regression results; in this case, monthly consumption typically exceeded 3,000,000 kWh, while

expected savings were less than one-half of one percent of this level.) Total square footage was adjusted, as in the lighting case, although the adjustment factor was very near one:

$$\frac{\sum_i sqft_i^{modified}}{\sum_i sqft_i} = 99.97\%$$

## Space-Cooling Impact Results

**Table 8**
**Space-Cooling Energy Load Impact Estimates--Participants and Nonparticipants**

| **Participants** | | | |
|---|---|---|---|
| | RMSE | | |
| | Satisfies RMSE Criterion | Does Not Satisfy RMSE Criterion | Grand Total |
| Total Estimated Impact (kWh per month) | -247,976 | 47,079 | -200,897 |
| Variance of Estimate | 2,926,601,981 | 578,747,385 | 3,505,349,366 |
| Total *Ex Ante* Estimate | 242,460 | 4,249 | 246,709 |
| Sample Size | 46 | 13 | 59 |
| Modified Square Footage | 4,317,373 | 550,132 | 4,867,505 |
| Estimated Designated Unit of Measurement | -0.6892 | | |
| | | | |
| Realization Rate Based on *Ex Ante* Estimates[4] | -222.3% | | |
| **Nonparticipants** | | | |
| | RMSE | | |
| Data | Satisfies RMSE Criterion | Does Not Satisfy RMSE Criterion | Grand Total |
| Total Estimated Impact | 124,768 | 213,440 | 338,209 |
| Variance of Estimate | 1,142,258,224 | 1,973,952,774 | 3,116,210,998 |
| Total Lighted Square Footage | 4,696,591 | 996,407 | 5,692,998 |
| Sample Size | 265 | 54 | 319 |
| Estimated Designated Unit of Measurement | 0.3188 | | |
| | | | |
| Estimated Net-to-Gross Ratio | 1.46 | | |

[4] The realization rate is defined as the sample ex post total estimated impacts to the sample ex ante total impacts.

**Space Cooling Demand Load Impact Estimates**

The space cooling gross demand estimate was derived using the gross energy estimate from the regression analysis adjusted by the system coincident peak load factor obtained from the 1996 Load Research space cooling end use recorder data. This system coincident peak load factor is defined as the ratio of the average demand (or the total annual energy consumption divided by 8760 hours) and the system coincident peak demand for the space cooling end use. The system coincident peak load factor for commercial space cooling was determined to be 0.54212.

The estimated gross demand savings is estimated by Equation 19:

**Equation 19 (Estimated Participant Demand Savings)**

$$\text{Est. TotalDemandSavings} = \frac{(247{,}976\,\text{kWh}) * 12}{8760\,\text{hours} * 0.54212} = 626.601\,\text{kW}$$

$$\text{Demand Savings (DUOM)} = \frac{626.601\,\text{kW}}{181{,}3584\,\text{sq. ft}} = 0.00035\,\text{kW per square foot}$$

with a realization rate of over 800%.

**Equation 20 (Estimated Nonparticipant Demand Savings)**

$$\text{Est. TotalDemandSavings} = \frac{(124{,}768\,\text{kWh}) * 12}{8760\,\text{hours} * 0.54212} = 315.272\,\text{kW}$$

$$\text{Demand Savings (DUOM)} = \frac{315.272\,\text{kW}}{7{,}355{,}073\,\text{sq.ft}} = 0.00004\,\text{kW per square foot}$$

The net impact is 0.00030 kW with a net-to-gross ratio of 87.6%.

# Section 4
# Military Sector By XENERGY

# 1996 COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM

## Military Sector

## FIRST YEAR LOAD IMPACT EVALUATION

### FINAL REPORT

### Study ID No. 992

**Prepared for**

**San Diego Gas & Electric**
**San Diego, California**

**Prepared by**

**XENERGY Inc.**
**San Diego, California**

**February 1998**

# 1 INTRODUCTION

## 1.1 INTRODUCTION

San Diego Gas & Electric (SDG&E) commissioned XENERGY Inc. to evaluate the first year load impacts of measures installed under its *1996 Commercial Energy Efficiency Incentives (CEEI) Program* in the military sector. These measures were installed to provide resource value by improving the energy efficiency of the facilities that participated in the *CEEI Program.*

The overall objectives of SDG&E's *1996 Commercial Energy Efficiency Incentives Program First Year Load Impact Evaluation for the Military Sector* were to:

- evaluate the gross and net load impacts of the measures installed at these facilities; and
- verify the physical installation of the measures identified in the program tracking system.

These objectives were accomplished using the following methodology:

- verifying the physical installation of the measures identified in the program tracking system (electronic and hard copy);
- gathering data through direct measurement, observation, and interviews with site personnel; and
- performing simplified engineering analysis of energy impacts based on the data.

## 1.2 DESCRIPTION OF SDG&E'S PROGRAM SUPPORT

SDG&E has worked with the U.S. Navy for a period of time to develop a positive working relationship that enabled the U.S. Navy to identify and quantify energy saving opportunities, seek funding and install energy efficient lighting projects at military bases located throughout SDG&E's service area during 1996. SDG&E worked with the Navy under a Basic Ordering Agreement (BOA) where SDG&E served as the prime contractor and worked on behalf of its client, the Navy. SDG&E hired subcontractors on a competitive basis, as required by the BOA, for the purpose of identifying energy saving opportunities and implementing them in the most cost-effective manner possible.

Through the CEEI program SDG&E developed the enabling infrastructure to assist the military in meeting its energy efficiency goals. SDG&E provided support to the military in the form of:

- audits and technical analysis that identified energy efficiency opportunities;
- assistance in documenting the savings necessary to apply for Department of Defense funding, including cost analysis with available financial incentives, preparation of Federal forms and supporting documentation;

- bid solicitation; including conducting pre-bid walkthroughs of sites, addressing questions from subcontractors, etc.; and
- project management, including construction management and post-retrofit quality assurance and compliance documentation required by the Government.

The documentation required by the military for funding such projects is extensive and exhaustive. SDG&E developed systems to produce these documents in a rather expeditious manner. The schedules tended to be very tight and labor intensive. SDG&E worked closely with the military to understand the requirements of the military both locally and nationally. In doing so, SDG&E was able to provide the level and intensity of effort necessary to enable the local efforts to be completed.

## 1.3 REPORT ORGANIZATION

The remainder of this report is organized as follows:

| | |
|---|---|
| Section 2 | Results |
| Section 3 | Lighting Measure Impact Estimation |
| Section 4 | Net-To-Gross Decision Analysis |
| Appendix A | Net-To-Gross Decision Analysis Data Form |
| Appendix B | Final As-Builts For Lighting System Retrofit for Family Housing |

# 2 RESULTS

## 2.1 OVERVIEW

This section provides a summary of results of the first year load impact evaluation of SDG&E's PY96 Commercial EEI Program for the military sector.

## 2.2 LIGHTING MEASURES

Table 2-1 shows the aggregated kWh impacts for interior lighting measures installed in the military sector during PY96.

**Table 2-1**
**Aggregated *Ex Post* kWh Savings**
**PY96 Commercial EEI Program**
**Military Sector**
**Lighting Measures**

| | |
|---|---|
| *Ex Ante* kWh Savings | 20,034,598 |
| *Ex Post* Gross kWh Savings | 12,747,925 |
| Net-to-Gross | 1.00 |
| *Ex Post* Net kWh Savings | 12,747,925 |
| Gross Realization Rate | 0.636 |
| *Ex Ante* Net kWh Savings | 15,729,544 |
| Net Realization Rate | 0.810 |
| Average Hours | 2,839 |
| Square Feet | 17,442,075 |
| DUOM, Gross Impacts | 0.2575 |
| DUOM, Net Impacts | 0.2575 |

Table 2-2 shows the aggregated kW impacts for interior lighting measures installed in the military sector during PY96.

**Table 2-2**
**Aggregated *Ex Post* kW Impacts**
**PY96 Commercial EEI Program**
**Military Sector**
**Lighting Measures**

| | |
|---|---|
| ***Ex Ante kW* Impacts** | **4,627.44** |
| ***Ex Post Gross kW* Impacts** | **3581.87** |
| Net-to-Gross | 1.00 |
| ***Ex Post* Net kW Impacts** | **3581.87** |
| **Gross Realization Rate** | **0.774** |
| ***Ex Ante* Net kW Impacts** | **3713.60** |
| **Net Realization Rate** | **0.965** |
| Average Hours | 2,839 |
| Square Feet | 17,442,075 |
| DUOM, Gross Impacts | 0.2054 |
| DUOM, Net Impacts | 0.2054 |

The military sector was stratified into the nonresidential building and family residential strata. Tables 2-3 and 2-4 show the first year kWh and kW impacts for the nonresidential stratum.

**Table 2-3**
***Ex Post* kWh Savings**
**PY96 Commercial EEI Program**
**Military Sector - Nonresidential Buildings**
**Lighting Measures**

| | |
|---|---|
| *Ex Ante* kWh Savings | 11,819,208 |
| Adjustment Factor - Hours of Operation | 1.040 |
| Adjustment Factor - Measure Installation | 0.936 |
| Adjustment Factor - Fixture Wattage | 0.972 |
| ***Ex Post* Gross kWh Savings** | **11,181,991** |
| Net-to-Gross | 1.00 |
| ***Ex Post* Net kWh Savings** | **11,181,991** |
| Gross Realization Rate | 0.946 |
| *Ex Ante* Net kWh Savings | 10,081,627 |
| Net Realization Rate | 1.109 |

**Table 2-4**
***Ex Post* Peak Coincident kW**
**PY96 Commercial EEI Program**
**Military Sector - Nonresidential Buildings**
**Lighting Measures**

| | |
|---|---|
| ***Ex Ante* kW Impacts** | **3254.98** |
| *Ex Ante* Coincidence Factor | 0.76 |
| Total *Ex Ante* Connected kW | 4282.87 |
| Adjustment Factor - Connected Watts | 0.9719 |
| *Ex Post* kW Coincidence Factor | 0.819 |
| ***Ex Post* Gross kW Impacts** | **3409.10** |
| Net-to-Gross | 1.00 |
| **Net kW Impacts** | **3409.10** |
| **Gross Realization Rate** | **1.047** |
| ***Ex Ante* Net kW Impacts** | **2767.26** |
| **Net Realization Rate** | **1.232** |

Tables 2-5 and 2-6 show the kWh and kW impacts for the family residential stratum.

**Table 2-5**
***Ex Post* kWh Impacts**
**PY96 Commercial EEI Program**
**Military Sector - Family Residential Buildings**
**Lighting Measures**

| | |
|---|---|
| *Ex Ante* kWh Savings | 8,215,390 |
| Adjustment Factor - Hours of Operation | 0.235 |
| Adjustment Factor - Measure Installation | 0.994 |
| Adjustment Factor - Fixture Wattage | 0.816 |
| *Ex Post* Gross kWh Savings | 1,565,934 |
| Net-to-Gross | 1.00 |
| *Ex Post* Net kWh Savings | 1,565,934 |
| Gross Realization Rate | 0.191 |
| *Ex Ante* Net kWh Savings | 5,647,917 |
| Net Realization Rate | 0.277 |

**Table 2-6**
***Ex Post* Peak Coincident kW**
**PY96 Commercial EEI Program**
**Military Sector - Family Residential Buildings**
**Lighting Measures**

| | |
|---|---|
| ***Ex Ante* kW Impacts** | **1,372.46** |
| *Ex Ante* Coincidence Factor | 0.76 |
| Total *Ex Ante* Connected kW | 1805.87 |
| Adjustment Factor - Connected Watts | 0.8163 |
| *Ex Post* kW Peak Coincidence Factor | 0.1172 |
| ***Ex Post* Gross kW Impacts** | **172.77** |
| Net-to-Gross | 1.00 |
| **Net kW Impacts** | **172.77** |
| **Gross Realization Rate** | **0.126** |
| ***Ex Ante* Net kW Impacts** | **946.34** |
| **Net Realization Rate** | **0.183** |

# 3 LIGHTING MEASURES

## 3.1 OVERVIEW

During PY96 San Diego Gas & Electric installed indoor lighting measures as part of its *Commercial Energy Efficiency Incentives Program (Commercial EEI Program).* A significant portion of these measures were installed at military facilities in SDG&E's service area. Due to the highly aggregated nature of utility services to the primary participants in the military sector, namely military bases throughout the SDG&E service area, SDG&E applied for a retroactive waiver to seek approval of an alternate approach to estimating *ex post* load impacts to those required for CEEI programs. Thus, as allowed by the retroactive waiver for SDG&E's Commercial EEI Program for measures installed in the military sector, Table C-5 of the *M&E Protocols* for Industrial Energy Efficiency Incentives Programs were applied to the military sector participants of SDG&E's 1996 Commercial EEI Program.

This section describes the methodology and presents the results of the first year *ex post* load impact evaluation of the lighting measures installed through the Commercial EEI Program during PY96. Table 3-1 shows an *ex ante* summary of the program under a broad definition of participant. This shows that 212,816 individual measures were installed saving an estimated 20,034,598 kWh per year at the sites of 23 facilities defined as participants. A participant is defined as a premise served by an electric meter. This definition does not provide a meaningful level of identification of the measure locations. The measures as described in the rest of this evaluation are identified at the building level for nonresidential buildings, and in aggregate for the family residential buildings. The ID No. is a unique variable that was used to identify specific buildings.

The measures were installed in a large number of buildings. There were two broad categories of building types: typical nonresidential buildings on a military base; and family residential dwelling on military bases. To address previous concerns regarding the evaluation of these residential units as part of a large-scale nonresidential evaluation, the total participant group was divided into the nonresidential and family residential strata. The same basic engineering approach was used to evaluate both strata, but the groups were sampled differently. Where the Industrial EEI Program protocols were followed for the nonresidential buildings, a residential sampling approach was followed, where a minimum of 200 sites were visited on-site.

**Table 3-1**
**Summary of *Ex Ante* Load Impacts By Participant**
**PY96 Commercial EEI Program**
**Military Sector**
**Lighting Measures**

| | | *Ex Ante* Gross | | *Ex Ante* Net | |
|---|---|---|---|---|---|
| **Participant** | **Measure Quantity** | **kWh Savings** | **kW Reduced** | **kWh Savings** | **kW Reduced** |
| 1 | 3,684 | 141,750 | 39.7 | 108,182 | 29.89 |
| 2 | 3,208.00 | 219,708 | 41.61 | 186,462 | 34.79 |
| 3 | 71,974 | 7,018,571 | 1,317.01 | 5,140,344 | 974.07 |
| 4 | 2,327 | 962,004 | 159.17 | 644,543 | 106.64 |
| 5 | 6 | 983 | 0.27 | 944 | 0.26 |
| 6 | 4 | 420 | 0.1 | 378 | 0.09 |
| 7 | 128 | 7,096 | 2.53 | 6,544 | 2.34 |
| 8 | 35 | 1,302 | 0.36 | 1,112 | 0.31 |
| 9 | 7,902 | 226,188 | 60.33 | 184,667 | 49.01 |
| 10 | 70 | 2,687 | 0.77 | 2,496 | 0.71 |
| 11 | 3,115 | 265,315 | 42.43 | 239,317 | 38.45 |
| 12 | 6,763 | 437,149 | 92.51 | 375,682 | 77 |
| 13 | 23,104 | 2,866,336 | 861.43 | 2,496,397 | 753.29 |
| 14 | 27,768 | 976,323 | 274 | 763,043 | 214.73 |
| 15 | 5,584 | 237,709 | 55.8 | 175,701 | 41.26 |
| 16 | 2,552 | 131,825 | 43.25 | 110,569 | 36.31 |
| 17 | 474 | 15,264 | 4.62 | 11,489 | 3.54 |
| 18 | 5,117 | 244,972 | 67.26 | 194,623 | 53.12 |
| 19 | 764 | 315,845 | 52.26 | 211,616 | 35.01 |
| 20 | 1,946 | 804,495 | 133.11 | 539,012 | 89.18 |
| 21 | 3,921.00 | 159,068 | 44.41 | 121,067 | 33.86 |
| 22 | 40,273 | 4,132,254 | 1,191.05 | 3,634,240 | 1,043.61 |
| 23 | 2,098 | 867,333 | 143.5 | 581,113 | 96.15 |
| **Total** | **212,816** | **20,034,598** | **4,627.44** | **15,729,544** | **3,713.61** |

Table 3-2 provides an overview of the nonresidential buildings. Of the 20 MWh savings, *ex ante*, measures installed in nonresidential buildings represent almost 60 percent of the energy savings. Table 3-3 shows there were 671 buildings where measures were installed, comprising over 12.8 million square feet.

**Table 3-2**
**Summary of *Ex Ante* Load Impacts for Nonresidential Buildings**
**PY96 Commercial EEI Program**
**Military Sector**
**Lighting Measures**

| | | *Ex Ante* Gross | | *Ex Ante* Net | |
|---|---|---|---|---|---|
| **Participant** | **Measure Quantity** | **kWh Savings** | **kW Reduced** | **kWh Savings** | **kW Reduced** |
| 1 | 3,684 | 141,750 | 39.7 | 108,182 | 29.89 |
| 2 | 3,208 | 219,708 | 41.61 | 186,462 | 34.79 |
| 3 | 39,694 | 1,752,858 | 432.58 | 1,468,711 | 354.71 |
| 4 | 6 | 983 | 0.27 | 944 | 0.26 |
| 5 | 4 | 420 | 0.1 | 378 | 0.09 |
| 6 | 128 | 7,096 | 2.53 | 6,544 | 2.34 |
| 7 | 35 | 1,302 | 0.36 | 1,112 | 0.31 |
| 8 | 7,902 | 226,188 | 60.33 | 184,667 | 49.01 |
| 9 | 70 | 2,687 | 0.77 | 2,496 | 0.71 |
| 10 | 3,115 | 265,315 | 42.43 | 239,317 | 38.45 |
| 11 | 6,763 | 437,149 | 92.51 | 375,682 | 77 |
| 12 | 23,104 | 2,866,336 | 861.43 | 2,496,397 | 753.29 |
| 13 | 27,768 | 976,323 | 274 | 763,043 | 214.73 |
| 14 | 5,584 | 237,709 | 55.8 | 175,701 | 41.26 |
| 15 | 2,552 | 131,825 | 43.25 | 110,569 | 36.31 |
| 16 | 474 | 15,264 | 4.62 | 11,489 | 3.54 |
| 17 | 5,117 | 244,972 | 67.26 | 194,623 | 53.12 |
| 18 | 3,921 | 159,068 | 44.41 | 121,067 | 33.86 |
| 19 | 40,273 | 4,132,254 | 1,191.05 | 3,634,240 | 1,043.61 |
| **Total** | **173,401** | **11,819,208** | **3,254.98** | **10,081,627** | **2,767.26** |

**Table 3-3**
**Nonresidential Building Summary**
**PY96 Commercial EEI Program**
**Military Sector**
**Lighting Measures**

| | |
|---|---|
| Number of Buildings | 671 |
| Total Square Feet (SF) | 12,887,814 |
| Smallest Building, SF | 35 |
| Largest Building, SF | 835,912 |

Table 3-4 shows the distribution of measure categories installed through the program.

**Table 3-4**
**Nonresidential Buildings**
***Ex Ante* Load Impacts by Measure Category**
**PY96 Commercial EEI Program**
**Military Sector**
**Lighting Measures**

| Measure Category | Description | Measure Quantity | *Ex Ante* Gross kWh Savings | *Ex Ante* Gross kW Reduced |
|---|---|---|---|---|
| T8-EB | T8 lamps with electronic ballasts | 164,758 | 6,611,773 | 1,891.37 |
| MH | Metal halide | 1,644 | 3,020,640 | 853.76 |
| CFL | Compact fluorescent lamps. | 5,683 | 1,604,928 | 348.28 |
| HPS | High pressure sodium | 201 | 223,313 | 89.23 |
| EXIT | LED exit signs | 636 | 179,912 | 20.54 |
| CONTROLS | Occupancy sensors, photocells | 272 | 73,976 | 22.25 |
| LPS | Low pressure sodium | 53 | 56,290 | 13.98 |
| HAL-PAR | Halogen, par lamps | 154 | 48,376 | 15.57 |
| **Total** | | **173,401** | **11,819,208** | **3,254.98** |

Table 3-5 shows that 8.2 MWh were saved, *ex ante*, through lighting measures installed in family residential buildings at military bases during PY96. Table 3-6 shows that the bulk of the savings come from hardwired compact fluorescent lamps.

**Table 3-5**
**Summary of *Ex Ante* Load Impacts**
**PY96 Commercial EEI Program**
**Military Sector - Family Residential Buildings**
**Lighting Measures**

| | | *Ex Ante* Gross | | *Ex Ante* Net | |
|---|---|---|---|---|---|
| Participant | Measure Quantity | kWh Savings | kW Reduced | kWh Savings | kW Reduced |
| 1 | 32,280 | 5,265,712 | 884.43 | 3,671,633 | 619.36 |
| 2 | 2,327 | 962,004 | 159.17 | 644,543 | 106.64 |
| 3 | 764 | 315,845 | 52.26 | 211,616 | 35.01 |
| 4 | 1,946 | 804,495 | 133.11 | 539,012 | 89.18 |
| 5 | 2,098 | 867,333 | 143.5 | 581,113 | 96.15 |
| **Total** | **39,415** | **8,215,390** | **1,372.46** | **5,647,917** | **946.34** |

**Table 3-6**
***Ex Ante* Load Impacts By Measure Category**
**PY96 Commercial EEI Program**
**Military Sector - Family Residential Buildings**
**Lighting Measures**

| Measure Category | Description | Measure Quantity | *Ex Ante* Gross kWh Savings | *Ex Ante* Gross kW Reduced |
|---|---|---|---|---|
| CFL | Compact fluorescent lamps, hardwired. | 18,747 | 7,595,928 | 1,256.77 |
| T8-EB | T8-lamps with electronic ballasts. | 20,668 | 619,462 | 115.69 |
| **Total** | | **39,415** | **8,215,390** | **1,372.46** |

## 3.2 *EX POST* EVALUATION APPROACH

To evaluate the lighting measures on-site verification visits were conducted at a sample of buildings. During these visits:

- the installation of the measures was verified and quantified;
- light loggers were installed and remained in place for a period of time to estimate hours of operation and/or interviews conducted to verify operating characteristics if logging was not possible; and
- spot measurements of a sample of fixtures were taken to estimate *ex post* connected watts.

The data collected were used to adjust the *ex ante* gross kWh impact estimates using a series of adjustment factors for:

- measure installation
- hours of operation
- post-retrofit connected watts

The resulting gross kWh impacts were then multiplied by the net-to-to-gross ratio that was estimated using the method described in Section 5 to estimate the gross load impacts.

Building lighted square footage was verified in nonresidential buildings by observation. The Navy has a comprehensive list of accurate building square footage that was the basis for the *ex ante* square footage figures. Thus, there was no deviation found in the field with the observed square footage. Similarly, the Navy maintains square footage for its family residential units. The square footage was verified in the family residential by comparing the *ex ante* estimates with Navy documents showing the square footage by housing area. There was no deviation found with these values. Thus, the *ex ante* estimates of square footage are much more reliable than those found for the general commercial sector and were the basis for calculating the DUOM.

## 3.3 *Ex Post* Load Impact Estimation for Nonresidential Buildings

A simplified engineering approach with verified inputs was used to evaluate the lighting program. On-site surveys of measure installation, spot measurement of post-retrofit fixture wattages, and the monitoring of the hours of operation were data collection methods used

.

### 3.3.1 Sampling

The sample for lighting measures was selected at the building level, as identified by the ID No. (*site_nbr* on the datasets), with individual lighting measures being aggregated by building. Total load impacts for each building were used as the primary selection criteria. Per the *M&E Protocols* for the IEEI Program, buildings that comprised 70 percent of the energy savings for the program in the military sector were selected for evaluation. The 672 building were sorted in order of load impacts. The buildings with the greatest consumption were selected until the cumulative total of those selected reached at least the 70 percent threshold.

As shown in Table 3-7 a total of 108 buildings were selected for the sample. These buildings accounted for 9.0 GWh, 76 percent of the total of 11.8 GWh, and 78 percent of the *ex ante* kW impacts.

**Table 3-7**
**Nonresidential Building Sample Fulfillment**
**PY96 Commercial EEI Program**
**Military Sector - Nonresidential Buildings**
**Lighting Measures**

| | No. Buildings | Measure Quantity | Ex Ante kWh Savings | Ex Ante kW Reduced |
|---|---|---|---|---|
| Surveyed | 108 | 107,271 | 9,049,334 | 2,527.72 |
| Participants | 672 | 173,401 | 11,819,208 | 3,254.98 |
| Percent of Total Participants | | | 0.766 | 0.777 |

### 3.3.2 Ex Post kWh Savings for Nonresidential Buildings

This section presents the estimation of *ex post* kWh savings for the measures installed in nonresidential buildings during PY96.

#### Estimation of Adjustment Factors

Several adjustment factors were estimated for hours of operation, measure installation and post-retrofit connected watts, as described previously. These factors were developed to adjust the

gross *ex ante* load impacts to reflect the conditions observed during the *ex post* on-site verification survey. This section describes the estimation of these adjustment factors.

### Measure Installation

Measure installations were verified and quantified. A realization rate was calculated for each measure. A weighted average of these realization rates was taken to estimate the adjustment factor for measure installations.

As shown in Table 3-8 the adjustment factor was 0.936, indicating that, about six percent of the measures installed were no longer in place. The primary reason for the removal of fixtures was the amount of remodeling the military undertook during 1997. The commands at several large facilities was undergoing a complete change, i.e., one command was leaving and another was moving in, necessitating a change of the facilities to meet the specific requirements of these occupants. It has been somewhat atypical for these extensive changes in command, however, with the Federal governments base closure and realignment activities the level of such transfers was more widespread than normal.

**Table 3-8**
**Adjustment Factor for Measure Installation**
**PY96 Commercial EEI Program**
**Military Sector - Nonresidential Buildings**
**Lighting Measures**

| **Measure Installation Adjustment Factor (Weighted by kWh Savings)** | **0.936** |
|---|---|
| *Ex Ante* Measure Counts for Surveyed Sites | 107,271 |
| *Ex Post* Measure Counts for Surveyed Sites | 95,190 |

### Hours of Operation

The *ex post* hours of operation for the lighting fixtures was estimated using light loggers that record the number of hours the light fixtures are on. Two types of light loggers were used: (1) run-time loggers that gather data on an aggregate basis; and (2) time-of-use (TOU) loggers that collect data allowing the estimation of the number of hours a fixture is turned-on on a time differentiated basis. The TOU logger data are downloaded from the logger via a serial port of a PC, and are accessible through proprietary software called SmartWare Ver. 3.2 from Pacific Science & Technology, Inc.

The *ex post* hours of operation was estimated for each site through the installation of light loggers at each facility. In most cases several loggers were installed throughout the building. The percent of time the lights are on were calculated for each logger and then annualized. The average annualized hours of operation were calculated for each building. A site-specific weighted average hours of operation for each participant was calculated for both *ex ante* and

*ex post*, using *ex ante* gross kWh savings as the weight, to account for the magnitude of impacts of the individual measures. Realization rates were calculated for each building by dividing the *ex post* hours by *ex ante* hours. The adjustment factor for hours of operation was estimated by taking the weighted average of the building realization rates, using the gross *ex ante* energy savings as the weight. The results are shown in Table 3-9.

**Table 3-9**
**Adjustment Factor for Hours of Operation**
**PY96 Commercial EEI Program**
**Military Sector - Nonresidential Buildings**
**Lighting Measures**

| | |
|---|---|
| **Monitored Buildings** | 108 |
| **Adjustment Factor for Hours of Operation** | 1.04 |

### Post-Retrofit Connected Watts

As part of the industrial protocols for M&V the measurement of end use connected loads is required in estimating pre- and post-retrofit load impacts. A series of spot measurements was taken on a sample of fixtures to estimate the adjustment factor for connected watts for the fixtures installed under the program. These measurements were compared to *ex ante* assumptions of the connected watts of post-retrofit fixtures and an adjustment factor for connected watts was estimated.

Due to the nature of the facilities, measurements at the fixture level were feasible. Volts and amps were measured. The power factor was assumed to be 1.00.

A raw adjustment factor was calculated by dividing the *ex ante* watts by the *ex post* watts for each measurement. Thus, if *ex post* watts is greater than *ex ante*, then the *ex post* load impacts will be less than the *ex ante*. Conversely, if *ex post* watts are less than *ex ante*, then the *ex post* load impacts will be greater than the *ex ante*.

The raw adjustment factors for the individual fixtures were weighted by the *ex ante* kWh savings aggregating by category of the fixture. Table 3-10 shows the weights used for the raw adjustment factors by measure category.

## Table 3-10
## Weight for Adjustment Factor for Fixture Wattage
## PY96 Commercial EEI Program
## Military Sector - Nonresidential Buildings
## Lighting Measures

| Measure Category | Ex Ante kWh Savings | Share | No. Measurements | Weight per Measurement |
|---|---|---|---|---|
| T8 Lamps with Electronic Ballasts | 6,611,773 | 0.577 | 46 | 0.0125 |
| Metal Halide | 3,020,640 | 0.264 | 11 | 0.0240 |
| CFL | 1,604,928 | 0.140 | 1 | 0.1400 |
| High Pressure Sodium | 223,313 | 0.019 | 4 | 0.0049 |
| Total | 11,460,654 | 1.000 | 62 | |

Table 3-11shows the results of the spot measurement of the 62 fixtures measured. It also shows the adjustment factor for fixture wattage to be 0.9719. This value indicates that the *ex post* measurements were slightly higher than the *ex ante* assumptions for the post-retrofit fixture.

## Table 3-11
## Adjustment Factor for Fixture Wattage
## PY96 Commercial EEI Program
## Military Sector - Nonresidential Buildings
## Lighting Measures

| | | | Ex Post | | | Ex Ante | | | |
|---|---|---|---|---|---|---|---|---|---|
| Measure Category | ID No. | Lighting | Volts | Amps per Fixture | Watts per Fixture | Watts per Fixture | Realization Rate (Ex Ante/Ex Post) | Weight | Adjustment Factor |
| T8 Lamps with Electronic Ballasts | 9944 | 2LF17EL | 120 | 0.300 | 36.0 | 32 | 0.8889 | 0.0125 | 0.0111 |
| | 9944 | 2LF17EL | 119.8 | 0.280 | 33.5 | 32 | 0.9540 | 0.0125 | 0.0120 |
| | 9944 | 2LF17EL | 119.9 | 0.290 | 34.8 | 32 | 0.9203 | 0.0125 | 0.0115 |
| | 8902 | 2LF17EL | 120 | 0.300 | 36.0 | 32 | 0.8889 | 0.0125 | 0.0111 |
| | 8902 | 2LF17EL | 120.1 | 0.300 | 36.0 | 32 | 0.8881 | 0.0125 | 0.0111 |
| | 8902 | 2LF17EL | 120.1 | 0.290 | 34.8 | 32 | 0.9188 | 0.0125 | 0.0115 |
| | 11980 | 2LF17EL | 119.2 | 0.300 | 35.8 | 32 | 0.8949 | 0.0125 | 0.0112 |
| | 11697 | 2LF17EL | 120 | 0.280 | 33.6 | 32 | 0.9524 | 0.0125 | 0.0119 |
| | 9806 | 2LF17EL | 120 | 0.295 | 35.4 | 32 | 0.9040 | 0.0125 | 0.0113 |
| | 9805 | 2LF17EL | 120 | 0.290 | 34.8 | 32 | 0.9195 | 0.0125 | 0.0115 |
| | 9805 | 2LF17EL | 120 | 0.293 | 35.2 | 32 | 0.9101 | 0.0125 | 0.0114 |
| | 9805 | 2LF17EL | 120 | 0.287 | 34.4 | 32 | 0.9292 | 0.0125 | 0.0117 |
| | 9965 | 2LF17EL-REF | 120 | 0.291 | 34.9 | 32 | 0.9164 | 0.0125 | 0.0115 |
| | 9965 | 2LF17EL-REF | 119.9 | 0.300 | 36.0 | 32 | 0.8896 | 0.0125 | 0.0112 |
| | 9965 | 2LF17EL-REF | 120 | 0.290 | 34.8 | 32 | 0.9195 | 0.0125 | 0.0115 |
| | 41089 | 2LF32EL | 119.4 | 0.496 | 59.2 | 58 | 0.9794 | 0.0125 | 0.0123 |
| | 9947 | 2LF32EL | 119.6 | 0.491 | 58.7 | 58 | 0.9877 | 0.0125 | 0.0124 |
| | 10182 | 2LF32EL | 119.9 | 0.494 | 59.2 | 58 | 0.9792 | 0.0125 | 0.0123 |
| | 9951 | 2LF32EL | 120.2 | 0.499 | 60.0 | 58 | 0.9670 | 0.0125 | 0.0121 |
| | 9951 | 2LF32EL | 119.5 | 0.512 | 61.2 | 58 | 0.9480 | 0.0125 | 0.0119 |
| | 11700 | 2LF32EL | 120 | 0.506 | 60.7 | 58 | 0.9552 | 0.0125 | 0.0120 |
| | 11700 | 2LF32EL | 120 | 0.510 | 61.2 | 58 | 0.9477 | 0.0125 | 0.0119 |
| | 11839 | 2LF32EL | 120 | 0.489 | 58.7 | 58 | 0.9884 | 0.0125 | 0.0124 |
| | 9806 | 2LF32EL | 120 | 0.491 | 58.9 | 58 | 0.9844 | 0.0125 | 0.0123 |
| | 9806 | 2LF32EL | 120 | 0.502 | 60.2 | 58 | 0.9628 | 0.0125 | 0.0121 |

## Table 3-11 (continued)
## Adjustment Factor for Fixture Wattage
## PY96 Commercial EEI Program
## Military Sector - Nonresidential Buildings
## Lighting Measures

| | | | Ex Post | | | Ex Ante | | | |
|---|---|---|---|---|---|---|---|---|---|
| Measure Category | ID No. | Lighting | Volts | Amps per Fixture | Watts per Fixture | Watts per Fixture | Realization Rate (Ex Ante/Ex Post) | Weight | Adjustment Factor |
| T8 Lamps with Electronic Ballasts | 9806 | 2LF32EL | 120 | 0.489 | **58.7** | **58** | 0.9884 | 0.0125 | 0.0124 |
| | 9806 | 2LF32EL | 120 | 0.490 | **58.8** | **58** | 0.9864 | 0.0125 | 0.0124 |
| | 9805 | 2LF32EL | 120 | 0.500 | **60.0** | **58** | 0.9667 | 0.0125 | 0.0121 |
| | 9741 | 2LF32EL | 120 | 0.489 | **58.7** | **58** | 0.9884 | 0.0125 | 0.0124 |
| | 9741 | 2LF32EL | 120 | 0.496 | **59.5** | **58** | 0.9745 | 0.0125 | 0.0122 |
| | 11697 | 2LF32EL-REF | 120.1 | 0.490 | **58.8** | **58** | 0.9856 | 0.0125 | 0.0124 |
| | 11839 | 2LF32EL-REF | 120 | 0.493 | **59.2** | **58** | 0.9804 | 0.0125 | 0.0123 |
| | 9805 | 2LF32EL-REF | 120 | 0.496 | **59.5** | **58** | 0.9745 | 0.0125 | 0.0122 |
| | 9741 | 2LF32EL-REF | 120 | 0.491 | **58.9** | **58** | 0.9844 | 0.0125 | 0.0123 |
| | 9741 | 2LF32EL-REF | 120 | 0.500 | **60.0** | **58** | 0.9667 | 0.0125 | 0.0121 |
| | 9741 | 2LF32EL-REF | 120 | 0.490 | **58.8** | **58** | 0.9864 | 0.0125 | 0.0124 |
| | 40225 | 2LF32ELREF | 120.2 | 0.495 | **59.5** | **58** | 0.9748 | 0.0125 | 0.0122 |
| | 40225 | 2LF32ELREF | 120 | 0.488 | **58.6** | **58** | 0.9904 | 0.0125 | 0.0124 |
| | 40225 | 2LF32ELREF | 120.3 | 0.499 | **60.0** | **58** | 0.9662 | 0.0125 | 0.0121 |
| | 10011 | 4LF32ELREF | 119.6 | 1.012 | **121.0** | **58** | 0.4792 | 0.0125 | 0.0060 |
| | 41931 | 2LF96T8EL | 120 | 1.020 | **122.4** | **113** | 0.9232 | 0.0125 | 0.0116 |
| | 11700 | 4LF32EL-REF | 120 | 1.046 | **125.5** | **116** | 0.9242 | 0.0125 | 0.0116 |
| | 43465 | 4LF32ELREF | 119.3 | 1.020 | **121.7** | **116** | 0.9533 | 0.0125 | 0.0120 |
| | 43465 | 4LF32ELREF | 119.3 | 1.000 | **119.3** | **116** | 0.9723 | 0.0125 | 0.0122 |
| | 43465 | 4LF32ELREF | 119.4 | 0.992 | **118.4** | **116** | 0.9794 | 0.0125 | 0.0123 |
| | 41089 | 4LF32ELREF | 118.8 | 1.020 | **121.2** | **116** | 0.9573 | 0.0125 | 0.0120 |
| CFL | 10182 | CFQ13 | 119.5 | 0.131 | **15.7** | **15** | 0.9582 | 0.1400 | 0.1342 |
| High Pressure Sodium | 41931 | HP150 | 119.8 | 1.461 | **175.0** | **188** | 1.0741 | 0.0049 | 0.0052 |
| | 41931 | HP150 | 120.1 | 1.470 | **176.5** | **188** | 1.0649 | 0.0049 | 0.0052 |
| | 11839 | HP150 | 120 | 1.470 | **176.4** | **188** | 1.0658 | 0.0049 | 0.0052 |
| | 11839 | HP150 | 120 | 1.450 | **174.0** | **188** | 1.0805 | 0.0049 | 0.0053 |
| Metal Halide | 11672 | MH100 | 120 | 1.020 | **122.4** | **129** | 1.0539 | 0.0155 | 0.0163 |
| | 11672 | MH100 | 120 | 1.010 | **121.2** | **129** | 1.0644 | 0.0155 | 0.0165 |
| | 11672 | MH100 | 120 | 1.090 | **130.8** | **129** | 0.9862 | 0.0155 | 0.0153 |
| | 11700 | MH250 | 120 | 2.340 | **280.8** | **295** | 1.0506 | 0.0155 | 0.0163 |
| | 11700 | MH250 | 120 | 2.330 | **279.6** | **295** | 1.0551 | 0.0155 | 0.0164 |
| | 9950 | MH400 | 118.7 | 3.690 | **438.0** | **465** | 1.0616 | 0.0155 | 0.0165 |
| | 9950 | MH400 | 118.9 | 3.680 | **437.6** | **465** | 1.0627 | 0.0155 | 0.0165 |
| | 9950 | MH400 | 118.8 | 3.680 | **437.2** | **465** | 1.0636 | 0.0155 | 0.0165 |
| | 10012 | MH400 | 119.8 | 3.680 | **440.9** | **465** | 1.0547 | 0.0155 | 0.0164 |
| | 10012 | MH400 | 120 | 3.660 | **439.2** | **465** | 1.0587 | 0.0155 | 0.0164 |
| | 10012 | MH400 | 120.2 | 3.670 | **441.1** | **465** | 1.0541 | 0.0155 | 0.0163 |
| | 44362 | MH1000 | 119.5 | 9.030 | **1,079.1** | **1100** | 1.0194 | 0.0155 | 0.0158 |
| | 44362 | MH1000 | 120.1 | 9.000 | **1,080.9** | **1100** | 1.0177 | 0.0155 | 0.0158 |
| | 44362 | MH1000 | 119.7 | 9.090 | **1,088.1** | **1100** | 1.0110 | 0.0155 | 0.0157 |
| | 11980 | MH1000 | 118.9 | 9.100 | **1,082.0** | **1100** | 1.0166 | 0.0155 | 0.0158 |
| | 11980 | MH1000 | 119.2 | 9.110 | **1,085.9** | **1100** | 1.0130 | 0.0155 | 0.0157 |
| | 11980 | MH1000 | 119.1 | 9.070 | **1,080.2** | **1100** | 1.0183 | 0.0155 | 0.0158 |
| Total | | | | | | | | **1.0000** | **0.9719** |

### *Calculation of Ex Post kWh Impacts - Nonresidential Buildings*

The *ex ante* gross load impact for the nonresidential buildings was multiplied by the adjustment factors for hours of operation, measure installation and post-retrofit fixture wattage. The *ex post* gross kWh value was multiplied by the net-to-gross ratio to arrive at the net kWh savings. Realization rates were estimated for both gross and net savings.

**Table 3-12**
***Ex Post* kWh Savings**
**PY96 Commercial EEI Program**
**Military Sector - Nonresidential Buildings**
**Lighting Measures**

| | |
|---|---|
| *Ex Ante* kWh Savings | 11,819,208 |
| Adjustment Factor - Hours of Operation | 1.040 |
| Adjustment Factor - Measure Installation | 0.936 |
| Adjustment Factor - Fixture Wattage | 0.972 |
| ***Ex Post* Gross kWh Savings** | **11,181,991** |
| Net-to-Gross | 1.00 |
| ***Ex Post* Net kWh Savings** | **11,181,991** |
| Gross Realization Rate | 0.946 |
| *Ex Ante* Net kWh Savings | 10,081,627 |
| Net Realization Rate | 1.109 |

## 3.3.3 Ex Post kW Impacts for Nonresidential Buildings

The *ex post* kW impact estimate was based on the TOU loggers that were in the field. The question that needed to be addressed was to determine whether the lights at a given building would have been turned on at the time of SDG&E system peak. In this case the system peak took place on September 4, 1997 at 15:30. Since the loggers were installed on a short-term basis, the measurement of the actual peak coincidence was not possible, i.e., whether the lights were on at 15:30 on September 4, 1997. The approach used to determine whether a set of monitored lights was turned on was to examine the TOU logger data and determine whether the lights of the logger would be on during the time from 13:00 to 15:00 on a weekday. This was done using the proprietary software called SmartWare Ver. 3.2 from Pacific Science & Technology, Inc.

**Table 3-13**
***Ex Post* Peak Coincidence Factor**
**PY96 Commercial EEI Program**
**Military Sector - Nonresidential Buildings**
**Lighting Measures**

| Status | Frequency | Percent |
|---|---|---|
| Off | 38 | 0.181 |
| On | 172 | 0.819 |
| Total | 210 | 1.000 |
| Peak Coincidence Factor | | 0.819 |

This factor was applied to the total connected kW, that was calculated by dividing the total *ex ante* kW impacts by the *ex ante* coincidence factor. The results are shown in Table 3-14.

**Table 3-14**
***Ex Post* Peak Coincident kW**
**PY96 Commercial EEI Program**
**Military Sector - Nonresidential Buildings**
**Lighting Measures**

| | |
|---|---|
| ***Ex Ante* kW Impacts** | **3254.98** |
| *Ex Ante* Coincidence Factor | 0.76 |
| Total *Ex Ante* Connected kW | 4282.87 |
| Adjustment Factor - Connected Watts | 0.9719 |
| *Ex Post* kW Coincidence Factor | 0.819 |
| ***Ex Post* Gross kW Impacts** | **3409.10** |
| Net-to-Gross | 1.00 |
| ***Ex Post* Net kW Impacts** | **3409.10** |
| **Gross Realization Rate** | **1.047** |
| ***Ex Ante* Net kW Impacts** | **2767.26** |
| **Net Realization Rate** | **1.232** |

## 3.4 *EX POST* LOAD IMPACT ESTIMATION FOR FAMILY RESIDENTIAL BUILDINGS

A total of 39,415 lighting measures were installed in family residential buildings under SDG&E's Commercial EEI Program during 1996. These measures were expected to save over 8 million kWh per year. The measures were installed in approximately 4,390 dwelling units comprising 4,554,261 lighted square feet of building space. The program tracking system extract shows the measures at an area defined by a housing development. Additional program documents showed final *as-builts* verified through a post-retrofit inspection. This inspection is an agreed upon task with the Navy and is a part of the requirement of the Navy to document the installation. XENERGY conducted on-site verification surveys at a sample of these units to

verify the installation and to install light loggers to verify the hours of operation *ex post*, as well as take spot measurements on a sample of fixtures to verify the post-retrofit fixture wattages.

### 3.4.1 Sampling

The sampling for the family residential buildings for the military sector was different than that used for the nonresidential buildings. To address concerns regarding the evaluation of these residential units as part of a large-scale nonresidential evaluation, the total military sector was divided into two strata. For the family residential stratum a random sample of 200 sites was selected for on-site visits. The final sample was 201 sites visited. *"Final As-Builts of the Lighting System Retrofit for Family Housing, Camp Pendleton, Delivery Order 12"* were obtained and used as the basis for the sampling. A copy of this document is included in Appendix B.

### 3.4.2 Ex Post kWh Savings for Family Residential Buildings

This section presents the estimation of *ex post* kWh savings for the measures installed in family residential buildings during PY96.

#### Estimation of Adjustment Factors

Several adjustment factors were estimated for hours of operation, measure installation and post-retrofit connected watts, as described previously. These factors were developed to adjust the gross *ex ante* load impacts to reflect the conditions observed during the *ex post* on-site verification survey. This section describes the estimation of these adjustment factors.

**Measure Installation**

Measure installations were verified and quantified. The *ex post* measure quantities were compared to an *ex ante* quantity obtained from the as-built lists for each unit surveyed. A realization rate, where the *ex post* verified measure quantities are divided by the *ex ante* measure quantities, was estimated across the survey sample and taken as the adjustment factor for measure installation.

As shown in Table 3-15 the adjustment factor was 0.9937, indicating that, less than one percent of the measures installed were no longer in place. This high installation rate is an expected outcome of the post-retrofit inspection employed as part of SDG&E's program, as well as the nature of the measures, i.e., all are hardwired fixtures, and the general low rate of remodeling taking place at these facilities.

**Table 3-15**
**Adjustment Factor for Measure Installation**
**PY96 Commercial EEI Program**
**Military Sector - Family Residential Buildings**
**Lighting Measures**

| **Measure Installation Adjustment Factor (Weighted by kWh Savings)** | **0.9937** |
|---|---|
| *Ex Ante* Measure Counts for Surveyed Sites | 1,262 |
| *Ex Post* Measure Counts for Surveyed Sites | 1,254 |

### Hours of Operation

The *ex post* hours of operation for the lighting fixtures was estimated using light loggers that record the number of hours the light fixtures are on. Two types of light loggers were used: (1) run-time loggers that gather data on an aggregate basis; and (2) time-of-use (TOU) loggers that collect data allowing the estimation of the number of hours a fixture is turned-on on a time of day basis. The TOU logger data are downloaded from the logger via a serial port of a PC, and are accessible through proprietary software called SmartWare Ver. 3.2 from Pacific Science & Technology, Inc.

The *ex post* hours of operation was estimated for each site through the installation of light loggers at each surveyed unit. In most cases the retrofit took place in the kitchen, hallway, or bathroom, since those areas are where the lights were installed. Two light loggers were placed in each unit. The rooms were selected on a rotating basis, where the rooms monitored rotated from unit to unit, thereby ensuring relatively even distribution across rooms throughout the sample. The percent of time the lights were on was calculated for each logger. The average was taken across the sample for the "percent on." The unadjusted *ex post* average hours of operation was calculated by annualizing the "percent on."

The unadjusted *ex post* hours were adjusted to account for the seasonality of interior lighting use. Since the monitoring period took place during the winter months and previous studies have shown that residential interior lighting usage is seasonal, the adjustment was made for the seasons by incorporating information from a study conducted for SDG&E titled *"Residential Appliance Efficiency Incentives: Compact Fluorescents, Impact Evaluation of the 1994 Program, Final Report,"* [1]. In this report, seasonal usage patterns were assessed incorporating data from a prior statewide study[2] as well as primary data. The seasonality adjustment factor was estimated by using data from Table 3-2 on page 3-3 of the aforementioned report and taking the

[1] Residential Appliance Efficiency Incentives: Compact Fluorescents, Impact Evaluation of the 1994 Program, Final Report, XENERGY Inc., February 26, 1996.

[2] Residential Statewide Lighting Study, Tasks 2 and 3: Transferability of Baseline and Metered Data, Barakat & Chamberlain, Inc., February 1994.

annualized hours of use of the current monitoring period (November through January) and dividing it into the annual hours of use estimated for the entire year. This ratio was 0.9123.

The estimate of the adjustment factor for hours of operation is shown in Table 3-16.

**Table 3-16**
**Adjustment Factor for Hours of Operation**
**PY96 Commercial EEI Program**
**Military Sector - Family Residential Buildings**
**Lighting Measures**

| | |
|---|---|
| Percent On | 0.1772 |
| Unadjusted *Ex Post* Verified Hours | 1,552 |
| *Ex Ante* Hours | 6,026 |
| Seasonal Adjustment Factor | 0.9123 |
| Adjustment Factor for Hours of Operation | 0.2350 |

### Post-Retrofit Connected Watts

As part of the industrial protocols for M&V the measurement of end use connected loads is required in estimating pre- and post-retrofit load impacts. A series of spot measurements was taken on a sample of fixtures to estimate the adjustment factor for connected watts for the fixtures installed under the program. These measurements were compared to *ex ante* assumptions of the connected watts of post-retrofit fixtures and an adjustment factor for connected watts was estimated.

Due to the nature of the facilities, measurements at the fixture level were feasible. Volts and amps were measured. The manufacturer of the fixture was surveyed to determine the power factor for the fixtures.

A raw adjustment factor was calculated by dividing the *ex ante* watts by the *ex post* watts for each measurement. Thus, if *ex post* watts is greater than the *ex ante*, the *ex post* load impacts will be less than the *ex ante*. Conversely, if *ex post* watts are less than *ex ante*, then the *ex post* load impacts will be greater than the *ex ante*.

The average of the realization rates for the individual fixtures was used to estimate the adjustment factor for fixture wattages. Table 3-17 shows the *ex post* measured wattage, *ex ante* fixture wattage and the adjustment factors.

## Table 3-17
## Adjustment Factor for Fixture Wattage
## PY96 Commercial EEI Program
## Military Sector - Family Residential Buildings
## Lighting Measures

| | | *Ex Post* Measurement | | | | | |
|---|---|---|---|---|---|---|---|
| **Measure Code** | **Location** | **Volts** | **Amps** | **Power Factor[1]** | ***Ex Post* Watts** | ***Ex Ante* Watts** | **Realization Rate** |
| L1-30 | kit | 123.3 | 0.49 | 0.66 | 39.88 | 30 | 0.7523 |
| L1-30 | kit | 121 | 0.46 | 0.66 | 36.74 | 30 | 0.8166 |
| L1-30 | hall | 120.3 | 0.52 | 0.66 | 41.29 | 30 | 0.7266 |
| L1-30 | kit | 120.3 | 0.52 | 0.66 | 41.29 | 30 | 0.7266 |
| L1-30 | kit | 120.8 | 0.5 | 0.66 | 39.86 | 30 | 0.7526 |
| L1-30 | hall | 120.8 | 0.49 | 0.66 | 39.07 | 30 | 0.7679 |
| L1-30 | dining | 120.8 | 0.46 | 0.66 | 36.67 | 30 | 0.8180 |
| L1-30 | kit | 120.2 | 0.49 | 0.66 | 38.87 | 30 | 0.7718 |
| L1-30 | dining | 120.2 | 0.48 | 0.66 | 38.08 | 30 | 0.7878 |
| L1-30 | hall | 120.2 | 0.5 | 0.66 | 39.67 | 30 | 0.7563 |
| L1-30 | hall | 120.7 | 0.5 | 0.66 | 39.83 | 30 | 0.7532 |
| L1-30 | dining | 120.7 | 0.48 | 0.66 | 38.24 | 30 | 0.7846 |
| L1-30 | hall | 120.1 | 0.45 | 0.66 | 35.67 | 30 | 0.8410 |
| L1-30 | dining | 120.1 | 0.51 | 0.66 | 40.43 | 30 | 0.7421 |
| L1-30 | hall | 120.9 | 0.52 | 0.66 | 41.49 | 30 | 0.7230 |
| L1-30 | kit | 120.9 | 0.5 | 0.66 | 39.90 | 30 | 0.7519 |
| L1-30 | dining | 120.3 | 0.48 | 0.66 | 38.11 | 30 | 0.7872 |
| L1-30 | hall | 120.3 | 0.48 | 0.66 | 38.11 | 30 | 0.7872 |
| L1-30 | hall | 120.3 | 0.45 | 0.66 | 35.73 | 30 | 0.8397 |
| L1-30 | hall | 120.6 | 0.49 | 0.66 | 39.00 | 30 | 0.7692 |
| L1-30 | dining | 120.6 | 0.49 | 0.66 | 39.00 | 30 | 0.7692 |
| L1-30 | hall | 117.8 | 0.46 | 0.66 | 35.76 | 30 | 0.8388 |
| L1-30 | kit | 115.9 | 0.46 | 0.66 | 35.19 | 30 | 0.8526 |
| L1-30 | kit | 118.4 | 0.45 | 0.66 | 35.16 | 30 | 0.8531 |
| L1-30 | hall | 121.5 | 0.47 | 0.66 | 37.69 | 30 | 0.7960 |
| L1-30 | hall | 124.6 | 0.46 | 0.66 | 37.83 | 30 | 0.7931 |
| L1-30 | hall | 122.3 | 0.54 | 0.66 | 43.59 | 30 | 0.6883 |
| L1-30 | hall | 124.1 | 0.45 | 0.66 | 36.86 | 30 | 0.8139 |
| L1-30 | rr | 121.5 | 0.42 | 0.66 | 33.68 | 30 | 0.8907 |
| L1-30 | rr | 116 | 0.42 | 0.66 | 32.16 | 30 | 0.9330 |
| L1-30 | hall | 117.3 | 0.43 | 0.66 | 33.29 | 30 | 0.9012 |
| L1-30 | hall | 116.5 | 0.45 | 0.66 | 34.60 | 30 | 0.8670 |
| L1-30 | hall | 121 | 0.48 | 0.66 | 38.33 | 30 | 0.7826 |
| L1-30 | rr | 120.5 | 0.45 | 0.66 | 35.79 | 30 | 0.8383 |
| L1-30 | rr | 117.2 | 0.42 | 0.66 | 32.49 | 30 | 0.9234 |
| L1-30 | rr | 117.9 | 0.44 | 0.66 | 34.24 | 30 | 0.8762 |
| L1-30 | hall | 116.8 | 0.41 | 0.66 | 31.61 | 30 | 0.9492 |
| L1-30 | kit | 114.5 | 0.4 | 0.66 | 30.23 | 30 | 0.9925 |
| L1-30 | rr | 118 | 0.44 | 0.66 | 34.27 | 30 | 0.8755 |
| L1-30 | hall | 121.3 | 0.43 | 0.66 | 34.42 | 30 | 0.8715 |
| L1-30 | hall | 122.3 | 0.41 | 0.66 | 33.09 | 30 | 0.9065 |
| **Adjustment Factor for Post Retrofit Connected Watts** | | | | | | | **0.8163** |
| Note 1: Source: Lights of America Technical Support | | | | | | | |

### *Calculation of Ex Post kWh Impacts - Family Residential Buildings*

The *ex ante* gross load impact for the nonresidential buildings was multiplied by the adjustment factors for hours of operation, measure installation and post-retrofit fixture wattage. The *ex post* gross kWh value was multiplied by the net-to-gross ratio to estimate the net kWh savings. Realization rates were estimated for both gross and net savings. Table 3-18 shows the results.

**Table 3-18**
***Ex Post* kWh Impacts**
**PY96 Commercial EEI Program**
**Military Sector - Family Residential Buildings**
**Lighting Measures**

| | |
|---|---|
| *Ex Ante* kWh Savings | 8,215,390 |
| Adjustment Factor - Hours of Operation | 0.235 |
| Adjustment Factor - Measure Installation | 0.994 |
| Adjustment Factor - Fixture Wattage | 0.816 |
| *Ex Post* Gross kWh Savings | 1,565,934 |
| Net-to-Gross | 1.00 |
| *Ex Post* Net kWh Savings | 1,565,934 |
| Gross Realization Rate | 0.191 |
| *Ex Ante* Net kWh Savings | 5,647,917 |
| Net Realization Rate | 0.277 |

## *3.4.3 Ex Post kW Impacts for Family Residential Buildings*

The *ex post* kW impact estimate was based on the TOU loggers that were placed in the field. The question that needed to be addressed was to determine whether the lights at a given building would have been turned on at the time of SDG&E system peak. For 1997 the system peak took place on September 4, 1997 at 15:30. Since the loggers were installed on a short-term basis, the measurement of the actual peak coincidence was not possible. The approach used to determine whether a set of monitored lights was turned on was to evaluate the TOU logger data and determine whether the lights of the logger would be on during the time from 13:00 to 15:00 on a summer weekday. This was done using the proprietary software called SmartWare Ver. 3.2 from Pacific Science & Technology, Inc.

Table 3-19 shows the estimation of the peak coincidence factor of 0.8828. This value compares with the value found in the *"Residential Appliance Efficiency Incentives: Compact Fluorescents, Impact Evaluation of the 1994 Program, Final Report,"* of 0.078.

**Table 3-19**
***Ex Post* Peak Coincidence Factor**
**PY96 Commercial EEI Program**
**Military Sector - Family Residential Buildings**
**Lighting Measures**

| Status | Frequency | Percent |
|---|---|---|
| Off | 128 | 0.8828 |
| On | 17 | 0.1172 |
| Total | 145 | 1.0000 |

This factor was applied to the total connected kW, that was calculated by dividing the total *ex ante* kW impacts by the *ex ante* coincidence factor. The results are shown in Table 3-20.

**Table 3-20**
***Ex Post* Peak Coincident kW**
**PY96 Commercial EEI Program**
**Military Sector - Family Residential Buildings**
**Lighting Measures**

| | |
|---|---|
| ***Ex Ante* kW Impacts** | **1,372.46** |
| *Ex Ante* Coincidence Factor | 0.76 |
| Total *Ex Ante* Connected kW | 1805.87 |
| Adjustment Factor - Connected Watts | 0.8163 |
| *Ex Post* kW Peak Coincidence Factor | 0.1172 |
| ***Ex Post* Gross kW Impacts** | **172.77** |
| Net-to-Gross | 1.00 |
| ***Ex Post* Net kW Impacts** | **172.77** |
| **Gross Realization Rate** | **0.126** |
| ***Ex Ante* Net kW Impacts** | **946.34** |
| **Net Realization Rate** | **0.183** |

# 4 NET-TO-GROSS ANALYSIS

## 4.1 OVERVIEW

XENERGY uses a consistent method for assessing whether a customer is a free rider with regard to a particular measure. The specific questions for a given measure are fitted to the way in which that measure is purchased and used. To be classified as a free rider, a customer must:

- have been aware of the availability of the efficient measure prior to hearing of the program;
- planned to implement the efficient measure within the time frame of the program; and
- been willing to pay the market price for the measure.

In addition to these conditions, XENERGY also seeks corroborating evidence regarding the customer's interest in the measure. For example, participants who reported that they had planned to implement the measure prior to the program were asked whether they had sought bids on the project.

The Decision Analysis data collection script consists of a series of questions designed to isolate the motivation for, and the timing of, installation of energy conservation equipment. To increase the probability that unbiased and accurate decision related data are collected, the questions are designed:

1. to help the customer separate their current thoughts about the project from their decision process at the time of program participation;
2. to prevent the customer from giving defensive or manipulated answers;
3. to identify and justify apparent inconsistencies in respondent's answers;
4. to ensure responses are obtained from a financial decision maker or that such a person's opinion is at least taken into account; and
5. to provide additional insight about the project decision-making, current satisfaction, and possible free driver effects.

Experience indicates that biased answers are likely to be obtained if surveyors simply ask participants if they would have undertaken similar equipment installations in the program's absence. One reason for this is that respondents tend to answer as if the question were "if you had it to do over again, would you do the same project, even if you couldn't get financing or had not received information?" Customers who are happy with their projects will tend to reply in the affirmative. Another reason is that if this is the only question asked, the respondent may

recognize the purpose of the question, and give the answer they think will have the desired effect on the program. An additional concern is that, while the main contact might have wanted to pursue the project even without utility involvement the investment might not actually have been approved under these conditions.

## 4.2 DESCRIPTION OF SDG&E'S PROGRAM SUPPORT

SDG&E has worked with the U.S. Navy for a period of time to develop a positive working relationship that enabled the U.S. Navy to identify and quantify energy saving opportunities, seek funding and install energy efficient lighting projects at military bases located throughout SDG&E's service area during 1996. SDG&E worked with the Navy under a Basic Ordering Agreement (BOA) where SDG&E served as the prime contractor and worked on behalf of its client, the Navy. SDG&E hired subcontractors on a competitive basis, as required by the BOA, for the purpose of identifying energy saving opportunities and implementing them in the most cost-effective manner possible.

Through the CEEI program SDG&E developed the enabling infrastructure to assist the military in meeting its energy efficiency goals. SDG&E provided support to the military in the form of:

- audits and technical analysis that identified energy efficiency opportunities;
- assistance in documenting the savings necessary to apply for Department of Defense funding, including cost analysis with available financial incentives, preparation of Federal forms and supporting documentation;
- bid solicitation; including conducting pre-bid walkthroughs of sites, addressing questions from subcontractors, etc.; and
- project management, including construction management and post-retrofit quality assurance and compliance documentation required by the Government.

The documentation required by the military for funding such projects is extensive and exhaustive. SDG&E developed systems to produce these documents in a rather expeditious manner. The schedules tended to be very tight and labor intensive. SDG&E worked closely with the military to understand the requirements of the military both locally and nationally. In doing so, SDG&E was able to provide the level and intensity of effort necessary to enable the local efforts to be completed.

## 4.3 LIGHTING MEASURES

In discussing the lighting portion of the SDG&E program with the participant, it was obvious that the effect SDG&E had on the installation was due to more than just the incentives. The respondent mentioned that, prior to these projects, the infrastructure was not available to do major retrofits. The respondent said that, without the SDG&E program, it would have been necessary to hire additional staff, and the SDG&E assistance made for "effective utilization of resources."

A respondent is considered a pure free rider if the customer would have installed the same equipment in the same time frame without the program. A respondent is considered a pure participant, the opposite of a free rider, if the customer would not have installed any of the measures and if the money would not have been approved without the program.

This respondent indicated that it was possible that if they had the SDG&E assistance with writing the technical specifications, doing the energy audits, etc. that 10 to 20 percent of the funds may have been approved without the incentive, but without the non-incentive assistance none of the lighting would have been installed. The respondent indicated that any lighting that would have been installed without the incentive may not have been as efficient, "it would not have been done as cheaply or as well." The participant said that the incentive improved the benefit-cost ratio and allowed the funding to be approved. The respondent was sure that if the SDG&E non-incentive assistance were unavailable, none of the funding would have been approved and none of the high efficiency lighting would have been installed. The respondent said that the non-incentive assistance, such as performing the energy audits, was necessary and without it none of the lighting would have been installed. These responses make it clear that the SDG&E assistance was necessary if the high efficiency lighting systems were going to be installed in any reasonable period of time. Therefore, the SDG&E program should be credited with all of the high efficiency lighting impacts.

The net-to-gross for lighting measures installed in the military sector for PY96 is 1.00.

The Decision Analysis data collection script is included in Appendix A.

# Appendix D

# Table 6
# Results Used to Support PY96 Second Earnings Claim

**SAN DIEGO GAS & ELECTRIC**
**M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY98 SECOND EARNINGS CLAIM FOR THE COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM**
**FIRST YEAR LOAD IMPACT EVALUATION, MARCH 1998, STUDY ID NO. 992**

Designated Unit of Measurement: LOAD IMPACTS PER SQUARE FOOT
**END USE: HVAC (Nonmilitary)**

| | | | | 5. A. 90% CONFIDENCE LEVEL | | | | 5. B. 80% CONFIDENCE LEVEL | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LOWER BOUND | UPPER BOUND | LOWER BOUND | UPPER BOUND | LOWER BOUND | UPPER BOUND | LOWER BOUND | UPPER BOUND |
| **1. Average Participant Group and Average Comaprison Group** | | **PART GRP** | **COMP GRP** | **PART GRP** | **PART GRP** | **COMP GRP** | **COMP GRP** | **PART GRP** | **PART GRP** | **COMP GRP** | **COMP GRP** |
| A. Pre-install usage: | A. i. Pre-install - kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. ii. Pre-install - kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. iii. Base kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. iv. Base kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. v. Base kW/ designated unit of measurement | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. vi.Base kWh/ designated unit of measurement | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| B. Impact year usage: | B. i. Impact Yr kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. ii. Impact Yr kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. iii. Impact Yr kW/designated unit | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. iv. Impact Yr kWh/designated unit | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **2. Average Net and Gross End Use Load Impacts** | | **AVG GROSS** | **AVG NET** | **AVG GROSS** | **AVG GROSS** | **AVG NET** | **AVG NET** | **AVG GROSS** | **AVG GROSS** | **AVG NET** | **AVG NET** |
| A. Load Impacts | A. i. Load Impacts - kW | 59.45 | 52.08 | 57.90 | 61.01 | 50.43 | 53.72 | 58.24 | 60.66 | 50.80 | 53.36 |
| | A. ii. Load Impacts - kWh | 54,857 | 80,091 | 47,466 | 62,248 | 72,284 | 87,899 | 49,097 | 60,617 | 74,006 | 86,176 |
| B. Load Impacts/designated unit | B. i. Load Impacts/designated unit - kW | 0.0003 | 0.0003 | 0.0003 | 0.0004 | 0.0002 | 0.0004 | 0.0003 | 0.0004 | 0.0003 | 0.0004 |
| | B. ii. Load Impacts/designated unit - kWh | 0.3188 | 0.4654 | 0.3187 | 0.3189 | 0.4654 | 0.4655 | 0.3187 | 0.3189 | 0.4654 | 0.4655 |
| C. % change in usage | C. i. a. % change in usage - Part Grp - kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | C. i. b. % change in usage - Part Grp - kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | C. ii. a. % change in usage - Comp Grp - kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | C. ii. b. % change in usage - Comp Grp - kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| D. Realization Rate: | D.A. i. Load Impacts - kW, realization rate | 822.6% | 800.6% | 801.1% | 844.2% | 775.4% | 825.9% | 805.8% | 839.4% | 780.9% | 820.3% |
| | D.A. ii. Load Impacts - kWh, realization rate | 101.2% | 164.2% | 87.6% | 114.8% | 148.2% | 180.2% | 90.6% | 111.8% | 151.7% | 176.7% |
| | D.B. i. Load Impacts/designated unit - kW, real rate | 822.6% | 800.6% | 822.6% | 822.6% | 566.2% | 1035.1% | 822.6% | 822.6% | 617.9% | 983.3% |
| | D.B. ii. Load Impacts/designated unit - kWh, real rate | 101.2% | 164.2% | 101.2% | 101.2% | 164.2% | 164.2% | 101.2% | 101.2% | 164.2% | 164.2% |
| **3. Net-to-Gross Ratios** | | **RATIO** | | **RATIO** | **RATIO** | | | **RATIO** | **RATIO** | | |
| A. Average Load Impacts | A. i. Average Load Impacts - kW | 87.6% | | 83.6% | 91.6% | | | 84.5% | 90.7% | | |
| | A. ii. Average Load Impacts - kWh | 146.0% | | 142.0% | 150.0% | | | 142.9% | 149.1% | | |
| B. Avg Load Impacts/designated unit of measurement | B. i. Avg Load Impacts/designated unit of measurement - kW | 87.6% | | -223.2% | 398.4% | | | -154.6% | 329.8% | | |
| | B. ii. Avg Load Impacts/designated unit of measurement - kWh | 146.0% | | -164.8% | 456.8% | | | -96.2% | 388.2% | | |
| C. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year | C. i. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kW | N/A | | N/A | N/A | | | N/A | N/A | | |
| | C. ii. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kWh | N/A | | N/A | N/A | | | N/A | N/A | | |
| **4. Designated Unit Intermediate Data** | | **PART GRP** | **COMP GRP** | **PART GRP** | **PART GRP** | **COMP GRP** | **COMP GRP** | **PART GRP** | **PART GRP** | **COMP GRP** | **COMP GRP** |
| | A. Pre-install average value | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. Post-install average value SQUARE FOOTAGE | 102,086,646 | 7,601,999 | 102,070,025 | 102,103,266 | 7,597,463 | 7,606,535 | 102,073,693 | 102,099,599 | 7,598,464 | 7,605,534 |
| **6. Measure Count Data** | | **NUMBER** | | | | | | | | | |
| | A. Number of measures installed by participants in Part Grp | *** | | | | | | | | | |
| | B. Number of measures installed by all program participants in the 12 months of the program year | *** | | | | | | | | | |
| | C. Number of measures installed by Comp Group | N/A | | | | | | | | | |
| **7. Market Segment Data** | | **SIC** | **PERCENT** | | | | | | | | |
| | Distribution by 2 digit SIC - Commercial/Industrial | *** | *** | | | | | | | | |

***Due to the volume of information, Measure Count Data and Market Segment Data are presented on the following pages.
Note: The ex ante DUOM calculation for the Nonmilitary Sector is shown after the Market Segment Data.

**SAN DIEGO GAS & ELECTRIC**
**M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY96 SECOND EARNINGS CLAIM FOR THE COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM**
**FIRST YEAR LOAD IMPACT EVALUATION, MARCH 1998, STUDY ID NO. 992**

Designated Unit of Measurement: LOAD IMPACTS PER SQUARE FOOT PER 1,000 HOURS OF OPERATION
**END USE: INDOOR LIGHTING ONLY (Nonmilitary)**

| | | | | 5. A. 90% CONFIDENCE LEVEL | | | | 5. B. 90% CONFIDENCE LEVEL | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LOWER BOUND | UPPER BOUND | LOWER BOUND | UPPER BOUND | LOWER BOUND | UPPER BOUND | LOWER BOUND | UPPER BOUND |
| **1. Average Participant Group and Average Comaprison Group** | | **PART GRP** | **COMP GRP** | **PART GRP** | **PART GRP** | **COMP GRP** | **COMP GRP** | **PART GRP** | **PART GRP** | **COMP GRP** | **COMP GRP** |
| A. Pre-install usage: | A. i. Pre-install - kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. ii. Pre-install - kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. iii. Base kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. iv. Base kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. v. Base kW/ designated unit of measurement | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. vi.Base kWh/ designated unit of measurement | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| B. Impact year usage: | B. i. Impact Yr kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. ii. Impact Yr kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. iii. Impact Yr kW/designated unit | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. iv. Impact Yr kWh/designated unit | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **2. Average Net and Gross End Use Load Impacts** | | **AVG GROSS** | **AVG NET** | **AVG GROSS** | **AVG GROSS** | **AVG NET** | **AVG NET** | **AVG GROSS** | **AVG GROSS** | **AVG NET** | **AVG NET** |
| A. Load Impacts | A. i. Load Impacts - kW | 4.37 | 3.40 | -796.89 | 805.62 | -808.08 | 814.89 | -620.08 | 628.81 | -629.01 | 635.82 |
| | A. ii. Load Impacts - kWh | 27,595 | 22,131 | -5,271,119 | 5,326,309 | -5,344,229 | 5,388,491 | -4,101,858 | 4,157,049 | -4,160,041 | 4,204,304 |
| B. Load Impacts/designated unit | B. i. Load Impacts/designated unit - kW | 0.04777 | 0.03726 | 0.00 | 0.09 | -0.01 | 0.08 | 0.01 | 0.08 | 0.04 | 0.07 |
| | B. ii. Load Impacts/designated unit - kWh | 0.05550 | 0.04451 | 0.049338 | 0.061662 | 0.04 | 0.05 | 0.04 | 0.07 | 0.04 | 0.05 |
| C. % change in usage | C. i. a. % change in usage - Part Grp - kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | C. i. b. % change in usage - Part Grp - kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | C. ii. a. % change in usage - Comp Grp - kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | C. ii. b. % change in usage - Comp Grp - kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| D. Realization Rate: | D.A. i. Load Impacts - kW, realization rate | 95.6% | 88.8% | -17453.8% | 17645.0% | -21070.1% | 21247.7% | -13581.2% | 13772.4% | -16401.0% | 16578.6% |
| | D.A. ii. Load Impacts - kWh, realization rate | 104.4% | 97.3% | -19940.1% | 20148.9% | -23507.8% | 23702.5% | -15516.9% | 15725.7% | -18298.9% | 18493.6% |
| | D.B. i. Load Impacts/designated unit - kW, real rate | 92.1% | 85.5% | #REF! | #REF! | -19.2% | 190.3% | #REF! | #REF! | 3.9% | 167.2% |
| | D.B. ii. Load Impacts/designated unit - kWh, real rate | 104.5% | 97.4% | 92.9% | 116.1% | 43.4% | 151.4% | 95.4% | 113.5% | 55.3% | 139.5% |
| **3. Net-to-Gross Ratios** | | **RATIO** | | **RATIO** | **RATIO** | | | **RATIO** | **RATIO** | | |
| A. Average Load Impacts | A. i. Average Load Impacts - kW | 78.0% | | 59.8% | 96.2% | | | 63.8% | 92.2% | | |
| | A. ii. Average Load Impacts - kWh | 80.2% | | 62.0% | 98.4% | | | 66.0% | 94.4% | | |
| B. Avg Load Impacts/designated unit of measurement | B. i. Avg Load Impacts/designated unit of measurement - kW | 78.0% | | 73.8% | 82.2% | | | 74.7% | 81.3% | | |
| | B. ii. Avg Load Impacts/designated unit of measurement - kWh | 80.2% | | 76.0% | 84.4% | | | 76.9% | 83.5% | | |
| C. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year | C. i. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kW | N/A | | N/A | N/A | | | N/A | N/A | | |
| | C. ii. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kWh | N/A | | N/A | N/A | | | N/A | N/A | | |
| **4. Designated Unit Intermediate Data** | | **PART GRP** | **COMP GRP** | **PART GRP** | **PART GRP** | **COMP GRP** | **COMP GRP** | **PART GRP** | **PART GRP** | **COMP GRP** | **COMP GRP** |
| | A. Pre-install average value | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. Post-install average value SQUARE FOOTAGE | 55,199 | 20,924 | 53,120 | 57,279 | 17,384 | 24,464 | 53,579 | 56,820 | 18,165 | 23,683 |
| | B. Post-install average value HOURS OF OPERATION | 5,692 | 6,337 | 5,641 | 5,743 | 6,097 | 6,577 | 5,652 | 5,732 | 6,150 | 6,524 |
| **5. Measure Count Data** | | **NUMBER** | | | | | | | | | |
| | A. Number of measures installed by participants in Part Group | *** | | | | | | | | | |
| | B. Number of measures installed by all program participants in the 12 months of the program year | *** | | | | | | | | | |
| | C. Number of measures installed by Comp Group | N/A | | | | | | | | | |
| **7. Market Segment Data** | | **SIC** | **PERCENT** | | | | | | | | |
| | Distribution by 3 digit SIC - Commercial/Industrial | *** | *** | | | | | | | | |

***Due to the volume of information, Measure Count Data and Market Segment Data are presented on the following pages.
Note: The ex ante DUOM calculation for the Nonmilitary Sector is shown after the Market Segment Data.

# Calculation of the *Ex Ante* DUOM for the Nonmilitary Group

**Lighting Load Impacts:**

$$Demand = \frac{Total\ \text{exante}\ kW}{No.of\ Units} = \frac{25{,}723.22}{496{,}081.297} = 0.05185\ kW$$

$$Energy = \frac{Total\ \text{ex ante}\ kWh}{No.of\ Units} = \frac{148{,}933{,}234}{2{,}803{,}185{,}281} = 0.05313\ kWh$$

MEASURE COST AND MEASURE COUNT DATA

SECTOR=COM STUDY=HVAC

| OBS | NEW_DESC | NEW_QTY | CUST_CST |
|---|---|---|---|
| 1 | DX A/C units | 4 | $1,562 |
| 2 | New Gas Boilers w/ Economizers | 2 | $27,000 |
| 3 | install VFD on 20-hp motor | 1 | $6,425 |
| 4 | install 1 2-ton air source heat pump | 1 | $376 |
| 5 | A/C Economizer | 1 | $2,101 |
| 6 | A/C: 4 Ton HVAC | 1 | $1,020 |
| 7 | A/C: 5 Ton HVAC | 2 | $2,550 |
| 8 | A/C: DX<4 ton | 1 | $952 |
| 9 | A/C: DX<5 ton | 3 | $2,869 |
| 10 | A/C: DX<5.4 ton | 18 | $15,840 |
| 11 | A/C: DX<5.4 ton (4ton) | 1 | $1,020 |
| 12 | A/C: 12<=DX<=20 ton | 7 | $6,121 |
| 13 | A/C: 2 Ton HVAC | 2 | $680 |
| 14 | A/C: 2.5 Ton HVAC | 1 | $425 |
| 15 | A/C: 5.4<=DX<12 ton | 5 | $4,653 |
| 16 | A/C:3 Ton | 2 | $1,020 |
| 17 | Air Handler w/ASD | 1 | $9,301 |
| 18 | Air Handlers With ASDs | 4 | $19,387 |
| 19 | ASD for One Cooling Tower | 1 | $14,951 |
| 20 | ASD on Condenser WtrPump 23 Secondary Pumps on CWL | 1 | $147,875 |
| 21 | ASD on 30 HP Fan Motor | 1 | $8,300 |
| 22 | ASD On 30 HP Fan Motor | 2 | $16,599 |
| 23 | ASDs | 4 | $28,318 |
| 24 | ASDs for AHU-16 and AH-15 | 2 | $29,266 |
| 25 | ASDs on 2-20HP Cooling Tower Fan Motors | 2 | $10,620 |
| 26 | ASDs on 2-15HP & 2-10HP Fan Motors | 4 | $12,464 |
| 27 | ASDs to Secondary Pumps | 2 | $6,500 |
| 28 | Baldor/Model ECP4104T-4 Motor 30HP | 1 | $154 |
| 29 | Carrier Corp/Model # 48HJD005531 A/C: DX<4 ton | 1 | $1,020 |
| 30 | Carrier Corp/Model #48HJE004531A/C: DX<3 ton | 1 | $765 |
| 31 | Carrier/Model # 48HJD008-5 A/C: 5.4<=DX<7.5 ton | 2 | $1,205 |
| 32 | Carrier/Model #48hjd006-5 A/C: DX<5 ton | 1 | $956 |
| 33 | Carrier/Model #48HJD004-3 A/C: DX<3 ton | 1 | $255 |
| 34 | Carrier/Model #48HJD006-3 A/C: DX<5 ton | 1 | $956 |
| 35 | Carrier/Model# 48HJD008 A/C: 5.4<=DX<12 ton | 3 | $3,164 |
| 36 | Chiller with ASD Motor Drive | 1 | $56,936 |
| 37 | Chiller Converted to Chilled Water Loop | 1 | $20,550 |
| 38 | Convectional Cooling Tower | 1 | $3,130 |
| 39 | Cooling Tower w/Smaller Spray Pump | 1 | $17,239 |
| 40 | Dayton/ Model # 5N300 Motor 1HP | 1 | $22 |
| 41 | Dayton/ Model # 5N300 Motor 1HP - 2HP | 2 | $45 |
| 42 | Dayton/Model # 3N017 Motor 1HP | 1 | $22 |
| 43 | Dayton/Model # 5N297 Motor 5HP | 1 | $54 |
| 44 | Dayton/Model # 5N300 Motor 1HP | 2 | $45 |
| 45 | Dayton/Model # 5N300 Motor 1HP - 2HP | 3 | $67 |
| 46 | Dayton/Model # 5N300 1HP | 1 | $22 |
| 47 | Dayton/Model# 5N297 Motor5HP | 1 | $54 |
| 48 | Dayton/Model# 5N300 Motor 1HP | 1 | $22 |
| 49 | DD VAV 38980 & 39080 CFM ASD | 1 | $72,500 |
| 50 | Economizers | 4 | $45,895 |
| 51 | Economizers D/X Pkg HP Units 6x7.5T, 5x5T & 6x4T | 17 | $2,725 |
| 52 | Efficient Hot Water Boilers 2500MBH & 1500MBH | 2 | $2,590 |
| 53 | Electronic timeclock | 2 | $610 |

SECTOR=COM STUDY=HVAC
(continued)

| OBS | NEW_DESC | NEW_QTY | CUST_CST |
|---|---|---|---|
| 54 | Electronic Timeclock | 18 | $5,490 |
| 55 | Electronic Timeclocks | 12 | $3,660 |
| 56 | Energy Efficiency Heat Pumps Split 22 Ton Total | 6 | $2,200 |
| 57 | Evaporative Coolers | 4 | $3,882 |
| 58 | Evening Thermostat Reset Programming | 1 | $650 |
| 59 | GE/Model#E834/Serial#64C7140009 Motor 15HP - 50HP | 1 | $128 |
| 60 | Heat Pump: AirSrc 24-65 MBH | 1 | $752 |
| 61 | Hi Eff Heat Pumps 4x5ton,2x6ton&1x7ton | 7 | $3,300 |
| 62 | High Eff Chiller With VFD | 1 | $23,700 |
| 63 | High Eff Gas Fired Boilers w/ Economizers | 3 | $36,052 |
| 64 | High Efficiency Boiler | 1 | $900 |
| 65 | High Efficiency Boilers | 4 | $6,770 |
| 66 | High Efficiency Centrifugal Chillers | 2 | $36,000 |
| 67 | High Efficiency Chiller | 1 | $55,000 |
| 68 | High Effiency Central Chiller | 1 | $135,000 |
| 69 | Install (4) 3.0 ton package units at 12 SEER | 4 | $2,040 |
| 70 | Install new air conditioning unit | 1 | $1,333 |
| 71 | Install new air to air heat pumps | 1 | $9,282 |
| 72 | Install VSD (Variable Speed Drive) | 1 | $6,130 |
| 73 | Install 1 3.5-ton air source heat pump | 1 | $658 |
| 74 | Install 1 3-ton air source heat pump | 1 | $564 |
| 75 | Install 1 5-ton air source heat pump | 1 | $940 |
| 76 | Install 2 3-ton air source heat pumps | 2 | $1,128 |
| 77 | Install 2 4-ton air source heat pump | 2 | $1,504 |
| 78 | Install 3 2.5-ton air source heat pump | 3 | $1,410 |
| 79 | Install 3 4-ton air source heat pump | 3 | $2,256 |
| 80 | Install 5 2.5 ton air source heat pump split syste | 5 | $2,350 |
| 81 | Leeson N404T11FB3 Motor 60HP | 1 | $397 |
| 82 | Leeson/Model # Cat #170013.60 Motor 30HP | 2 | $307 |
| 83 | Magnetek-Motor 3HP - 10HP | 1 | $32 |
| 84 | Magnetek/Model # E101 Motor 1HP - 2HP | 1 | $34 |
| 85 | Magnetek/Model # E636 Motor 25HP | 1 | $128 |
| 86 | Magnetek/Model#7355646328 Motor 3HP - 10HP | 1 | $54 |
| 87 | Marathon /Model # 3VC-284TTDP4026Motor 30HP | 1 | $128 |
| 88 | Marathon/Model# 3VC286TTOP40260CLMotor 30HP | 1 | $154 |
| 89 | Motor 1HP - 2HP | 1 | $45 |
| 90 | Motor 15HP - 50HP | 15 | $1,998 |
| 91 | Motor 3HP - 10HP | 17 | $1,140 |
| 92 | Motor 60HP - 200HP | 3 | $2,148 |
| 93 | New Economizer & Controls | 1 | $7,960 |
| 94 | One VFD for Supply & Return Air Fan Combination | 5 | $27,335 |
| 95 | Pony motor on cooling tower | 1 | $2,730 |
| 96 | Pony Motor 15HP/3HP, Reset CW Temp To 80 Deg | 1 | $1,500 |
| 97 | Prop Fan Cooling Tower Single Speed | 1 | $4,244 |
| 98 | Reliance P32G4551Motor 50 | 1 | $256 |
| 99 | Repair Economizer on 70 Ton Unit | 3 | $3,243 |
| 100 | Roof insulation | 1 | $2,450 |
| 101 | Swimming Pool Transparent Covers For 2 Pools | 1 | $5,758 |
| 102 | Time Clock Control System for 25 WSHP | 1 | $7,431 |
| 103 | Toshiba Model # B0104FLF24SH03 Motor 3HP - 10HP | 1 | $108 |
| 104 | Toshiba-Motor 3HP-10HP | 1 | $54 |
| 105 | Toshiba/Model # BY154FLF2AMH03 Motor 1.5 | 1 | $34 |

MEASURE COST AND MEASURE COUNT DATA

SECTOR=COM STUDY=HVAC (continued)

| OBS | NEW_DESC | NEW_QTY | CUST_CST |
|---|---|---|---|
| 106 | Toshiba/Model # B0024FLF2AMH03 Motor 2HP | 1 | $45 |
| 107 | Toshiba/Model # B0154FLF2USH Motor 15HP | 1 | $77 |
| 108 | Toshiba/Model # B0204FLF2USH02 Motor 20HP | 1 | $102 |
| 109 | Toshiba/Model #B0034FLL2AMH Motor 3HP | 1 | $32 |
| 110 | TECO/Model # Maue-1 Motor 10HP | 1 | $108 |
| 111 | Us/Model# Z23R030 3HP - 10HP | 1 | $54 |
| 112 | US /R352 Motor 15HP - 50HP | 1 | $102 |
| 113 | US Electric/Model # N326A-Z082134R036M Motor 25HP | 1 | $128 |
| 114 | US Motor/Model # G29304 Motor 1HP - 2HP | 4 | $179 |
| 115 | US/model# H320 Motor 15HP - 50HP | 1 | $77 |
| 116 | US/Model# A435 Motor 3HP - 10HP | 1 | $81 |
| 117 | US/Model# A441 Motor 15HP - 50HP | 1 | $77 |
| 118 | US/Model# J364 Motor 15HP - 50HP | 1 | $128 |
| 119 | US/Model# R357 Motor 15HP - 50HP | 1 | $205 |
| 120 | USEM model # A425Motor 1HP - 2HP | 1 | $45 |
| 121 | VFD for AH Supply & Return Air Fan Combo | 1 | $5,933 |
| 122 | VFD on Cooling Tower Fan Motor | 1 | $16,327 |
| 123 | VFD on 1-15 HP & 1-25HP | 2 | $15,753 |
| 124 | VFDs 8x10 HP Supply & Return Air Fan Combo | 8 | $33,642 |
| 125 | VSD on AH-6 | 1 | $7,765 |
| 126 | VSDs for Air Handlers | 38 | $155,655 |
| 127 | VSDs On Fan Motors - 25HP | 12 | $59,992 |
| 128 | Zone Night Set Back Re Programming | 1 | $2,560 |
| 129 | 1 ton air source heat pump | 66 | $46,134 |
| 130 | 15 Hp Hi Efficiency Motor | 1 | $77 |
| 131 | 15 HP Hi Efficiency Motor | 1 | $77 |
| 132 | 15,485 Solar  Film | 1 | $24,776 |
| 133 | 2-5 ton 12.3 SEER A/C units | 2 | $1,955 |
| 134 | 3 Hp Hi Efficiency Motor | 1 | $32 |
| 135 | 3HP Hi Efficiency Motor | 1 | $32 |
| 136 | 38HDCL024-310  2Ton Carrier AC | 1 | $340 |
| 137 | 4x20HP Supply & 4x10HP Return ASDs | 8 | $45,906 |
| 138 | 40 HP Hi Efficiency Motor | 1 | $205 |
| 139 | 40.0-ton 10.7 EER DX A/C unit | 1 | $1,319 |
| 140 | 5 HP Pony Motor | 1 | $2,790 |

SECTOR=COM STUDY=LIGHTING

| OBS | NEW_DESC | NEW_QTY | CUST_CST |
|---|---|---|---|
| 141 | occupancy sensors | 310 | $7,440 |
| 142 | photocells | 30 | $2,400 |
| 143 | to install occupancy sensors | 6 | $144 |
| 144 | CF-13Q Hardwire Fxtr | 5,008 | $375,600 |
| 145 | CF-18 Hardwire Fxtr | 89 | $6,675 |
| 146 | CF-26 or CF-28 Hardwire Fxtr | 1,110 | $83,250 |
| 147 | CF-7 Hardwire Fxtr | 160 | $12,000 |
| 148 | CF-9 Hardwire Fxtr | 2,385 | $178,875 |
| 149 | Delamp (4 ft) | 2,346 | $-9,689 |
| 150 | Dimmers on Halogen lamps | 1 | $20 |
| 151 | Electronic Bal (8ft) | 690 | $29,477 |

MEASURE COST AND MEASURE COUNT DATA

SECTOR=COM STUDY=LIGHTING
(continued)

| OBS | NEW_DESC | NEW_QTY | CUST_CST |
|---|---|---|---|
| 204 | 1CFQ26H | 15 | $466 |
| 205 | 1FO17/.5B2-17T8 | 4 | $10 |
| 206 | 1FO17/1B2-17T8 | 99 | $2,894 |
| 207 | 1FO17/1B2-17T8/1DLAMP2 | 1 | $30 |
| 208 | 1FO17/1B2-17T8/1R2-D1 | 22 | $529 |
| 209 | 1FO25/.25B3-EL | 39 | $761 |
| 210 | 1FO25/.33B3-T8 | 7 | $150 |
| 211 | 1FO25/.5B3-EL | 50 | $778 |
| 212 | 1FO25/.5B3-T8 | 84 | $1,756 |
| 213 | 1FO25/1B3-EL | 126 | $3,322 |
| 214 | 1FO25/1B3-T8 | 455 | $6,838 |
| 215 | 1FO32/.25B4-EL | 4 | $100 |
| 216 | 1FO32/1B4T8-2L | 76 | $2,652 |
| 217 | 1FO32/1B4T8-2L/1DLAMP | 45 | $1,302 |
| 218 | 1FO32/1B4T8-2L/1DLAMP2 | 3 | $225 |
| 219 | 1FO32/1B4T8-2L/1R4-D0 | 23 | $444 |
| 220 | 1F72/1B6-EL | 1 | $33 |
| 221 | 1HP100/0B4-ST | 12 | $887 |
| 222 | 1HP35 | 13 | $923 |
| 223 | 1I125IR | 236 | $4,720 |
| 224 | 1I45PCF | 47 | $233 |
| 225 | 1I45PCF3 | 68 | $570 |
| 226 | 1MH150 | 40 | $8,523 |
| 227 | 1MH250 | 33 | $10,395 |
| 228 | 1MH250/B-COMPCT | 104 | $33,788 |
| 229 | 1MH70 | 4 | $-21,990 |
| 230 | 1UO31/1B2-31T8 | 90 | $3,949 |
| 231 | 1XLEDK1 | 38 | $1,304 |
| 232 | 10-20-35W 3-way CF Circline | 4,322 | $159,914 |
| 233 | 11-15W CFL | 16,937 | $429,437 |
| 234 | 11-15W Replacement CFL | 81,620 | $308,524 |
| 235 | 13-15W CFL w/Reflector | 3,113 | $110,645 |
| 236 | 16-20W CFL | 9,971 | $364,487 |
| 237 | 16-20W Replacement CFL | 2,324 | $8,785 |
| 238 | 16-24W CFL w/Reflector | 581 | $21,017 |
| 239 | 19-30W CF Fixture (Inside) | 20,523 | $1,357,596 |
| 240 | 2CC69H | 130 | $3,937 |
| 241 | 2FO17/.5B2-17T8/2DLAMP2 | 22 | $532 |
| 242 | 2FO17/1B2-17T8 | 617 | $17,189 |
| 243 | 2FO17/1B2-17T8/1DLAMP | 29 | $1,327 |
| 244 | 2FO17/1B2-17T8/1R2-D0 | 10 | $819 |
| 245 | 2FO17/1B2-17T8/1R2-D2 | 4,395 | $173,127 |
| 246 | 2FO17/1B2-17T8/2DLAMP2 | 13 | $381 |
| 247 | 2FO25/.5B3-T8 | 2 | $60 |
| 248 | 2FO25/1B3-EL | 164 | $5,906 |
| 249 | 2FO25/1B3-T8 | 437 | $13,312 |
| 250 | 2FO25/1B3-T8/1R6-D1 | 1 | $33 |
| 251 | 2FO32/.5B4T8-4L | 105 | $4,225 |
| 252 | 2FO32/.5B4T8-4L/1DLAMP8 | 38 | $-2,518 |
| 253 | 2FO32/.5B4T8-4L/2DLAMP | 64 | $1,816 |
| 254 | 2FO32/1B4T8-2L | 2,503 | $81,984 |
| 255 | 2FO32/1B4T8-2L/1DLAMP8 | 120 | $3,183 |

MEASURE COST AND MEASURE COUNT DATA

SECTOR=COM STUDY=LIGHTING
(continued)

| OBS | NEW_DESC | NEW_QTY | CUST_CST |
|---|---|---|---|
| 152 | Exit Sign Kit (LED) | 15,570 | $-1,926,476 |
| 153 | Exit Sign Kit (LED) 1 Face Green | 936 | $-115,811 |
| 154 | Exit Sign Kit (LED) 1 Face Red | 9,138 | $-1,130,645 |
| 155 | Exit Sign Kit (LED) 2 Face Green | 160 | $-19,797 |
| 156 | Exit Sign Kit (LED) 2 Face Red | 1,435 | $-177,553 |
| 157 | Exit Sign LED 1 Side with Battery | 31,310 | $-3,157,300 |
| 158 | Exit Sign LED 1 Side wo/Battery | 2,172 | $-219,024 |
| 159 | Exit Sign LED 2 Side with Battery | 4,397 | $-443,393 |
| 160 | Exit Sign LED 2 Side wo/Battery | 1,202 | $-121,210 |
| 161 | Exit Sign Replacement (LED) | 11 | $-1,109 |
| 162 | Hybrid Bal (4ft/2la) | 37 | $938 |
| 163 | Install ceiling mounted occupancy sensor | 1 | $24 |
| 164 | Install ceiling mounted occupancy sensors | 2 | $48 |
| 165 | Install occupancy sensor | 23 | $552 |
| 166 | Install occupancy sensors | 298 | $7,152 |
| 167 | Install Occupancy Sensor | 12 | $288 |
| 168 | Install Occupancy Sensors | 375 | $9,000 |
| 169 | Install Occupancy Sensors in Small Office | 1 | $24 |
| 170 | Install OS in Dressing Rooms & Offices | 16 | $384 |
| 171 | Install Sensors in Makeup & Dressing Rms with no r | 4 | $96 |
| 172 | Install Twist Timer | 1 | $65 |
| 173 | Ltg Sys with  8 Skylights & 1 Common Photocells | 1 | $7,292 |
| 174 | Ltg Sys with 13 Skylights & 1 Common Photocell | 1 | $11,686 |
| 175 | LED Night light | 723 | $-161,851 |
| 176 | No Watt Power Reducers 96" 2 Lamp Fixtures | 1,777 | $20,511 |
| 177 | No Watt Power Reducers 96" 2 Lamps Fixtures | 960 | $11,081 |
| 178 | Occupancy sensors | 171 | $4,104 |
| 179 | Occupancy Sensor | 9 | $216 |
| 180 | Occupancy Sensors | 776 | $18,702 |
| 181 | Occupancy Sensors w/power pack | 50 | $1,200 |
| 182 | Opt Refl(4ft/1dlamp) | 18,175 | $265,173 |
| 183 | Opt Refl(4ft/2dlamp) | 21,316 | $222,965 |
| 184 | Opt Refl(8ft/1dlamp) | 255 | $7,135 |
| 185 | Photocell | 1 | $220 |
| 186 | Photocell Daylighting Controls | 36 | $4,716 |
| 187 | T-12 El Bal(4ft/2la) | 13 | $349 |
| 188 | T-8 El Bal (4ft/2la) | 91,553 | $2,250,360 |
| 189 | T-8 El Bal (4ft/3la) | 5,861 | $161,478 |
| 190 | T-8 El Bal (4ft/4la) | 14,586 | $418,319 |
| 191 | Time Clock | 1 | $389 |
| 192 | Timeclocks | 1 | $100 |
| 193 | 1 occupancy sensor | 2 | $48 |
| 194 | 1CC22H | 4 | $77 |
| 195 | 1CE20H | 4 | $33 |
| 196 | 1CE20H/1B-COMPCT | 2 | $9 |
| 197 | 1CE22S | 41 | $631 |
| 198 | 1CE30H | 192 | $5,203 |
| 199 | 1CFQE20H | 1 | $12 |
| 200 | 1CFQ13H | 42 | $1,670 |
| 201 | 1CFQ13S | 144 | $-9,392 |
| 202 | 1CFQ18S | 6 | $66 |
| 203 | 1CFQ20S | 2 | $24 |

MEASURE COST AND MEASURE COUNT DATA

SECTOR=COM STUDY=LIGHTING
(continued)

| OBS | NEW_DESC | NEW_QTY | CUST_CST |
|---|---|---|---|
| 256 | 2FO32/1B4T8-2L/1R4-D0 | 98 | $4,536 |
| 257 | 2FO32/1B4T8-2L/1R4-D1 | 8 | $550 |
| 258 | 2FO32/1B4T8-2L/1R4-D2 | 1,201 | $93,150 |
| 259 | 2FO32/1B4T8-2L/1R8-D1 | 359 | $17,254 |
| 260 | 2FO32/1B4T8-2L/2DLAMP | 13 | $549 |
| 261 | 2FO32/1B4T8-2L/2DLAMP2 | 4 | $331 |
| 262 | 2FO32/1B4T8-2L/2R4-D0 | 4 | $-61 |
| 263 | 2FO32/1B4T8-2L/2R4-D1 | 302 | $13,048 |
| 264 | 2FO32/1B4T8-2L/2R4-D2 | 76 | $1,212 |
| 265 | 2FO32/1B4T8-2L/2R4-D3 | 16 | $261 |
| 266 | 2FO96/1B8-T8/2DLAMP8 | 7 | $-732 |
| 267 | 2F72/1B6-EL | 215 | $12,578 |
| 268 | 2UO31/1B2-31T8 | 1,084 | $40,376 |
| 269 | 2UO31/1B4T8-2L | 60 | $3,007 |
| 270 | 2XCF5K | 10 | $-133 |
| 271 | 21-25W CFL | 18,304 | $523,576 |
| 272 | 21-25W Replacement CFL | 5,511 | $20,832 |
| 273 | 26-30W Replacement CFL | 564 | $2,132 |
| 274 | 26-32W CFL | 5,472 | $73,602 |
| 275 | 3FO17/1B2-17T8/1DLAMP2 | 27 | $1,195 |
| 276 | 3FO17/1B2-17T8/1R2-D0 | 8 | $-735 |
| 277 | 3FO17/1B2-17T8/1R2-D1 | 1,942 | $83,425 |
| 278 | 3FO17/1B2-17T8/2R2-D1 | 10 | $688 |
| 279 | 3FO25/1B3-T8/1R3-D1 | 1 | $47 |
| 280 | 3FO25/2B3-T8 | 174 | $9,783 |
| 281 | 3FO32/1B4T8-3L | 6 | $280 |
| 282 | 32 Watt lamp | 249,754 | $1,361,159 |
| 283 | 4FO17/1B2-17T8 | 114 | $4,972 |
| 284 | 4FO25/1B3-EL | 73 | $808 |
| 285 | 4FO25/1B3-T8 | 37 | $1,469 |
| 286 | 4FO25/2B3-EL | 24 | $1,203 |
| 287 | 4FO32/1B4T8-4L | 5,414 | $152,614 |
| 288 | 4FO32/1B4T8-4L/1DLAMP | 54 | $2,565 |
| 289 | 4FO32/1B4T8-4L/1DLAMP8 | 18 | $1,188 |
| 290 | 4FO32/1B4T8-4L/1R4-D0 | 289 | $16,052 |
| 291 | 4FO32/1B4T8-4L/1R8-D0 | 532 | $27,697 |
| 292 | 4FO32/1B4T8-4L/1R8-D1 | 1 | $61 |
| 293 | 4FO32/1B4T8-4L/2DLAMP | 1 | $18 |
| 294 | 4FO32/1B4T8-4L/2DLAMP8 | 16 | $344 |
| 295 | 4FO32/1B4T8-4L/2R4-D0 | 1,008 | $44,899 |
| 296 | 4FO32/1B4T8-4L/2R4-D1 | 7 | $409 |
| 297 | 4FO32/1B4T8-4L/2R4-D2 | 332 | $5,562 |
| 298 | 4FO32/1B4T8-4L/2R4-D4 | 53 | $-170 |
| 299 | 4FO32/1B4T8-4L/2R8-D1 | 38 | $266 |
| 300 | 4FO32/1B4T8-4L/4R4-D0 | 60 | $6,869 |
| 301 | 4FO32/2B4T8-2L/2R4-D0 | 3 | $180 |
| 302 | 5-10W CFL | 12,864 | $412,920 |
| 303 | 5-10W Replacement CFL | 49,996 | $188,985 |
| 304 | 6FO32/2B4T8-3L/1DLAMP8 | 86 | $4,186 |
| 305 | 6FO32/2B4T8-3L/2R4-D0 | 126 | $5,278 |
| 306 | 8FO25/2B3-EL | 2 | $173 |
| 307 | 8FO32/2B4T8-4L | 247 | $30,331 |

THREE-DIGIT SIC CODE LISTING

SECTOR=COM STUDY=HVAC

| OBS | SIC3 | COUNT |
|---|---|---|
| 1 | 078 | 1 |
| 2 | 422 | 1 |
| 3 | 458 | 1 |
| 4 | 481 | 1 |
| 5 | 493 | 1 |
| 6 | 495 | 1 |
| 7 | 504 | 3 |
| 8 | 506 | 1 |
| 9 | 508 | 1 |
| 10 | 509 | 1 |
| 11 | 519 | 1 |
| 12 | 525 | 2 |
| 13 | 531 | 3 |
| 14 | 541 | 2 |
| 15 | 543 | 1 |
| 16 | 553 | 1 |
| 17 | 554 | 1 |
| 18 | 555 | 1 |
| 19 | 581 | 8 |
| 20 | 591 | 1 |
| 21 | 593 | 1 |
| 22 | 602 | 10 |
| 23 | 611 | 1 |
| 24 | 615 | 1 |
| 25 | 641 | 2 |
| 26 | 651 | 13 |
| 27 | 653 | 5 |
| 28 | 655 | 2 |
| 29 | 701 | 8 |
| 30 | 737 | 1 |
| 31 | 738 | 1 |
| 32 | 753 | 1 |
| 33 | 799 | 3 |
| 34 | 805 | 2 |
| 35 | 806 | 6 |
| 36 | 807 | 1 |
| 37 | 809 | 2 |
| 38 | 811 | 1 |
| 39 | 821 | 7 |
| 40 | 822 | 8 |
| 41 | 836 | 1 |
| 42 | 866 | 3 |
| 43 | 871 | 2 |
| 44 | 872 | 1 |
| 45 | 873 | 7 |
| 46 | 919 | 2 |
| 47 | 921 | 1 |
| 48 | 922 | 1 |
| 49 | 961 | 1 |

THREE-DIGIT SIC CODE LISTING

SECTOR=COM STUDY=LIGHTING

| OBS | SIC3 | COUNT |
|---|---|---|
| 50 | 074 | 4 |
| 51 | 411 | 1 |
| 52 | 412 | 1 |
| 53 | 413 | 2 |
| 54 | 421 | 8 |
| 55 | 422 | 61 |
| 56 | 449 | 1 |
| 57 | 451 | 2 |
| 58 | 458 | 1 |
| 59 | 472 | 4 |
| 60 | 478 | 1 |
| 61 | 481 | 10 |
| 62 | 483 | 2 |
| 63 | 484 | 2 |
| 64 | 489 | 1 |
| 65 | 491 | 2 |
| 66 | 492 | 1 |
| 67 | 495 | 9 |
| 68 | 501 | 4 |
| 69 | 502 | 7 |
| 70 | 503 | 7 |
| 71 | 504 | 21 |
| 72 | 505 | 2 |
| 73 | 506 | 23 |
| 74 | 507 | 6 |
| 75 | 508 | 22 |
| 76 | 509 | 8 |
| 77 | 511 | 14 |
| 78 | 512 | 3 |
| 79 | 513 | 7 |
| 80 | 514 | 19 |
| 81 | 515 | 1 |
| 82 | 516 | 10 |
| 83 | 517 | 1 |
| 84 | 518 | 3 |
| 85 | 519 | 22 |
| 86 | 521 | 5 |
| 87 | 523 | 11 |
| 88 | 525 | 7 |
| 89 | 526 | 5 |
| 90 | 531 | 24 |
| 91 | 533 | 7 |
| 92 | 539 | 3 |
| 93 | 541 | 56 |
| 94 | 542 | 3 |
| 95 | 543 | 1 |
| 96 | 544 | 7 |
| 97 | 545 | 1 |
| 98 | 546 | 12 |
| 99 | 549 | 11 |
| 100 | 551 | 22 |
| 101 | 552 | 1 |
| 102 | 553 | 11 |

THREE-DIGIT SIC CODE LISTING

SECTOR=COM STUDY=LIGHTING
(continued)

| OBS | SIC3 | COUNT |
|---|---|---|
| 103 | 554 | 15 |
| 104 | 555 | 1 |
| 105 | 557 | 3 |
| 106 | 559 | 1 |
| 107 | 561 | 9 |
| 108 | 562 | 12 |
| 109 | 563 | 2 |
| 110 | 564 | 7 |
| 111 | 565 | 14 |
| 112 | 566 | 12 |
| 113 | 569 | 7 |
| 114 | 571 | 75 |
| 115 | 572 | 5 |
| 116 | 573 | 22 |
| 117 | 581 | 673 |
| 118 | 591 | 13 |
| 119 | 592 | 11 |
| 120 | 593 | 30 |
| 121 | 594 | 81 |
| 122 | 596 | 3 |
| 123 | 599 | 116 |
| 124 | 600 | 30 |
| 125 | 601 | 1 |
| 126 | 602 | 44 |
| 127 | 603 | 30 |
| 128 | 606 | 8 |
| 129 | 609 | 2 |
| 130 | 614 | 4 |
| 131 | 615 | 1 |
| 132 | 616 | 13 |
| 133 | 621 | 11 |
| 134 | 628 | 7 |
| 135 | 631 | 1 |
| 136 | 632 | 2 |
| 137 | 636 | 1 |
| 138 | 637 | 1 |
| 139 | 639 | 1 |
| 140 | 641 | 26 |
| 141 | 651 | 636 |
| 142 | 653 | 217 |
| 143 | 655 | 58 |
| 144 | 671 | 2 |
| 145 | 672 | 5 |
| 146 | 673 | 1 |
| 147 | 679 | 9 |
| 148 | 701 | 266 |
| 149 | 702 | 1 |
| 150 | 703 | 1 |
| 151 | 704 | 2 |
| 152 | 721 | 15 |
| 153 | 722 | 3 |
| 154 | 723 | 28 |

THREE-DIGIT SIC CODE LISTING

SECTOR=COM STUDY=LIGHTING
(continued)

| OBS | SIC3 | COUNT |
|---|---|---|
| 155 | 725 | 1 |
| 156 | 726 | 10 |
| 157 | 729 | 11 |
| 158 | 731 | 3 |
| 159 | 732 | 3 |
| 160 | 733 | 15 |
| 161 | 734 | 2 |
| 162 | 735 | 5 |
| 163 | 736 | 2 |
| 164 | 737 | 25 |
| 165 | 738 | 37 |
| 166 | 751 | 3 |
| 167 | 752 | 1 |
| 168 | 753 | 16 |
| 169 | 754 | 7 |
| 170 | 762 | 1 |
| 171 | 763 | 1 |
| 172 | 769 | 6 |
| 173 | 781 | 3 |
| 174 | 783 | 22 |
| 175 | 784 | 6 |
| 176 | 791 | 4 |
| 177 | 792 | 7 |
| 178 | 793 | 10 |
| 179 | 794 | 1 |
| 180 | 799 | 95 |
| 181 | 801 | 80 |
| 182 | 802 | 16 |
| 183 | 804 | 18 |
| 184 | 805 | 52 |
| 185 | 806 | 30 |
| 186 | 807 | 10 |
| 187 | 808 | 1 |
| 188 | 809 | 11 |
| 189 | 811 | 17 |
| 190 | 821 | 101 |
| 191 | 822 | 26 |
| 192 | 823 | 4 |
| 193 | 824 | 8 |
| 194 | 829 | 7 |
| 195 | 832 | 37 |
| 196 | 833 | 4 |
| 197 | 835 | 43 |
| 198 | 836 | 28 |
| 199 | 839 | 7 |
| 200 | 841 | 5 |
| 201 | 861 | 9 |
| 202 | 862 | 6 |
| 203 | 863 | 3 |
| 204 | 864 | 73 |
| 205 | 866 | 441 |
| 206 | 869 | 12 |

THREE-DIGIT SIC CODE LISTING

SECTOR=COM STUDY=LIGHTING
(continued)

| OBS | SIC3 | COUNT |
|---|---|---|
| 207 | 871 | 26 |
| 208 | 872 | 3 |
| 209 | 873 | 43 |
| 210 | 874 | 5 |
| 211 | 899 | 7 |
| 212 | 911 | 6 |
| 213 | 919 | 42 |
| 214 | 922 | 43 |
| 215 | 931 | 2 |
| 216 | 941 | 2 |
| 217 | 943 | 4 |
| 218 | 944 | 1 |
| 219 | 951 | 1 |
| 220 | 953 | 1 |
| 221 | 962 | 9 |
| 222 | 963 | 1 |
| 223 | 971 | 1 |
| 224 | 972 | 5 |

**SAN DIEGO GAS & ELECTRIC**

**M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY96 SECOND EARNINGS CLAIM FOR COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM, MILITARY SECTOR**

**FIRST YEAR LOAD IMPACT EVALUATION, FEBRUARY 1998, STUDY ID NO. 992**

**Designated Unit of Measurement:** LOAD IMPACTS PER AFFECTED SQUARE FOOT PER 1000 HOURS OF OPERATION.
**End Use:** Interior Lighting (Military)

| | | | | 5. A. 90% CONFIDENCE LEVEL | | | | 5. B. 90% CONFIDENCE LEVEL | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LOWER BOUND | UPPER BOUND | LOWER BOUND | UPPER BOUND | LOWER BOUND | UPPER BOUND | LOWER BOUND | UPPER BOUND |
| 1. Average Participant Group and Average Comparison Group | | PART GRP | COMP GRP | PART GRP | PART GRP | COMP GRP | COMP GRP | PART GRP | PART GRP | COMP GRP | COMP GRP |
| A. Pre-install usage: | A. i. Pre-install - kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. ii. Pre-install - kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. iii. Base kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. iv. Base kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. v. Base kW/ designated unit of measurement | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. vi.Base kWh/ designated unit of measurement | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| B. Impact year usage: | B. i. Impact Yr kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. ii. Impact Yr kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. iii. Impact Yr kW/designated unit | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. iv. Impact Yr kWh/designated unit | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 2. Average Net and Gross End Use Load Impacts | | AVG GROSS | AVG NET | AVG GROSS | AVG GROSS | AVG NET | AVG NET | AVG GROSS | AVG GROSS | AVG NET | AVG NET |
| A. Load Impacts | A. i. Load Impacts - kW | 155.7335 | 155.7335 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | A. ii. Load Impacts - kWh | 554,258 | 554,258 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| B. Load Impacts/designated unit | B. i. Load Impacts/designated unit - kW | 0.2054 | 0.2054 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. ii. Load Impacts/designated unit - kWh | 0.2574 | 0.2574 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C. % change in usage | C. i. a. % change in usage - Part Grp - kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | C. i. b. % change in usage - Part Grp - kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | C. ii. a. % change in usage - Comp Grp - kW | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | C. ii. b. % change in usage - Comp Grp - kWh | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| D. Realization Rate: | D.A. i. Load Impacts - kW, realization rate | 0.7741 | 0.9645 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | D.A. ii. Load Impacts - kWh, realization rate | 0.6363 | 0.8104 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | D.B. i. Load Impacts/designated unit - kW, real rate | 0.8569 | 0.9020 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | D.B. ii. Load Impacts/designated unit - kWh, real rate | 1.0606 | 1.1167 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 3. Net-to-Gross Ratios | | RATIO | | RATIO | RATIO | | | RATIO | RATIO | | |
| | A. i. Average Load Impacts - kW | 1.00 | | N/A | N/A | | | N/A | N/A | | |
| | A. ii. Average Load Impacts - kWh | 1.00 | | N/A | N/A | | | N/A | N/A | | |
| | B. i. Avg Load Impacts/designated unit of measurement - kW | 1.00 | | N/A | N/A | | | N/A | N/A | | |
| | B. ii. Avg Load Impacts/designated unit of measurement - kWh | 1.00 | | N/A | N/A | | | N/A | N/A | | |
| | C. i. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kW | N/A | | N/A | N/A | | | N/A | N/A | | |
| | C. ii. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kWh | N/A | | N/A | N/A | | | N/A | N/A | | |
| 4. Designated Unit Intermediate Data | | PART GRP | COMP GRP | PART GRP | PART GRP | COMP GRP | COMP GRP | PART GRP | PART GRP | COMP GRP | COMP GRP |
| | A. Pre-install average value | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | B. Post-install average value | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 6. Measure Count Data | | NUMBER | | | | | | | | | |
| | A. Number of measures installed by participants in Part Group | 108,533 | | | | | | | | | |
| | B. Number of measures installed by all program participants in the 12 months of the program year | 212,816 | | | | | | | | | |
| | C. Number of measures installed by Comp Group | N/A | | | | | | | | | |
| 7. Market Segment Data | | SIC or CZ | PERCENT | | | | | | | | |
| | Distribution by 3 digit SIC - Commercial/Industrial | 653 | 0.3 | | | | | | | | |
| | | 971 | 99.7 | | | | | | | | |

The SAS System
SDGE Commercial EEI Program, Military Sector PY96 Lighting Measures
Measure Summary

| OBS | NEW_DESC | _TYPE_ | _FREQ_ | CUST_CST | NEW_QTY |
|---|---|---|---|---|---|
| 1 | 11-15W CFL | 0 | 17 | $33,943 | 1,027 |
| 2 | 19-30W CF Fixture (Inside) | 0 | 26 | $1,188,451 | 17,966 |
| 3 | 1CE30H | 0 | 12 | $10,656 | 444 |
| 4 | 1FO17/1B2-17T8 | 0 | 7 | $234 | 9 |
| 5 | 1FO17/1B2-17T8/1DLAMP | 0 | 1 | $25 | 1 |
| 6 | 1FO25/1B3-T8 | 0 | 10 | $33,900 | 1,006 |
| 7 | 1HP150 | 0 | 2 | $-83,535 | 164 |
| 8 | 1HP70 | 0 | 2 | $3,918 | 37 |
| 9 | 1I45PCF | 0 | 7 | $280 | 28 |
| 10 | 1I45PCF3 | 0 | 8 | $650 | 117 |
| 11 | 1I60PC3 | 0 | 2 | $81 | 9 |
| 12 | 1LP135 | 0 | 1 | $1,072 | 3 |
| 13 | 1LP18 | 0 | 1 | $575 | 3 |
| 14 | 1LP180 | 0 | 3 | $8,930 | 23 |
| 15 | 1LP55 | 0 | 2 | $2,344 | 15 |
| 16 | 1LP90 | 0 | 1 | $3,830 | 9 |
| 17 | 1MH100 | 0 | 5 | $15,544 | 75 |
| 18 | 1MH1000 | 0 | 1 | $96 | 88 |
| 19 | 1MH1000/B-COMPCT | 0 | 1 | $261,475 | 276 |
| 20 | 1MH175 | 0 | 1 | $-1,033 | 25 |
| 21 | 1MH250 | 0 | 3 | $170,503 | 515 |
| 22 | 1MH400 | 0 | 4 | $235,600 | 561 |
| 23 | 1MH400/B-COMPCT | 0 | 2 | $29,232 | 104 |
| 24 | 26-32W CFL | 0 | 1 | $117 | 9 |
| 25 | 2FO17/1B2-17T8 | 0 | 48 | $18,094 | 653 |
| 26 | 2FO17/1B2-17T8/1R2-DO | 0 | 22 | $13,723 | 526 |
| 27 | 2FO17/1B2-17T8/1R2-D2 | 0 | 16 | $33,563 | 750 |
| 28 | 2FO17/1B2-17T8/2DLAMP2 | 0 | 2 | $84 | 2 |
| 29 | 2FO17/1B2-17T8/2R2-D2 | 0 | 1 | $2,081 | 56 |

The SAS System
SDGE Commercial EEI Program, Military Sector PY96 Lighting Measures
Measure Summary

| OBS | NEW_DESC | _TYPE_ | _FREQ_ | CUST_CST | NEW_QTY |
|---|---|---|---|---|---|
| 30 | 2F025/1B3-T8 | 0 | 29 | $12,662 | 468 |
| 31 | 2F032/1B4T8-2L | 0 | 4 | $6,845 | 96 |
| 32 | 2F032/1B4T8-2L/1R8-D1 | 0 | 1 | $173 | 21 |
| 33 | 2F040/1B5-EL | 0 | 3 | $24,135 | 1,003 |
| 34 | 2F072/1B6-EL | 0 | 1 | $652 | 5 |
| 35 | 2F096/1B8-T8 | 0 | 2 | $949 | 22 |
| 36 | 2U031/1B2-31T8 | 0 | 2 | $5,651 | 89 |
| 37 | 2U031/1B2-31T8/1R2-D0 | 0 | 1 | $606 | 13 |
| 38 | 2U031/1B2-31T8/1R4-D0 | 0 | 1 | $3,145 | 42 |
| 39 | 2U031/1B2-31T8/2R2-D0 | 0 | 4 | $1,061 | 18 |
| 40 | 32 Watt lamp | 0 | 1357 | $573,781 | 105,281 |
| 41 | 3F017/1B2-17T8/1R2-D1 | 0 | 1 | $351 | 5 |
| 42 | 3F017/2B2-17T8/1R2-D0 | 0 | 1 | $570 | 20 |
| 43 | 4F025/1B3-T8 | 0 | 2 | $179 | 3 |
| 44 | 4F032/1B4T8-4L | 0 | 3 | $13,103 | 110 |
| 45 | 4F032/1B4T8-4L/1DLAMP8 | 0 | 1 | $4,349 | 51 |
| 46 | 4F032/1B4T8-4L/1R4-D0 | 0 | 11 | $-86,887 | 1,323 |
| 47 | 4F032/1B4T8-4L/1R8-D1 | 0 | 1 | $1,751 | 10 |
| 48 | 4F032/1B4T8-4L/1R8-D2 | 0 | 1 | $389 | 8 |
| 49 | 4F032/1B4T8-4L/2R4-D0 | 0 | 33 | $-238,248 | 1,714 |
| 50 | 4F032/1B4T8-4L/2R4-D1 | 0 | 1 | $1,156 | 14 |
| 51 | 4F032/2B4T8-2L/1R4-D0 | 0 | 1 | $6,396 | 252 |
| 52 | CF-13Q Hardwire Fxtr | 0 | 302 | $225,900 | 3,012 |
| 53 | CF-18 Hardwire Fxtr | 0 | 7 | $26,175 | 349 |
| 54 | CF-26 or CF-28 Hardwire Fxtr | 0 | 190 | $121,725 | 1,623 |
| 55 | Delamp (4 ft) | 0 | 145 | $-13,369 | 3,237 |
| 56 | Electronic Bal (8ft) | 0 | 130 | $170,923 | 4,001 |
| 57 | Exit Sign Kit (LED) | 0 | 20 | $-16,580 | 134 |
| 58 | Exit Sign Replacement (LED) | 0 | 98 | $-50,622 | 502 |

The SAS System
SDGE Commercial EEI Program, Military Sector PY96 Lighting Measures
Measure Summary

| OBS | NEW_DESC | _TYPE_ | _FREQ_ | CUST_CST | NEW_QTY |
|---|---|---|---|---|---|
| 59 | Hybrid Bal (4ft/2la) | 0 | 1 | $101 | 4 |
| 60 | Install Occuapancy Sensors | 0 | 1 | $312 | 13 |
| 61 | Install Occupancy Sensor | 0 | 6 | $144 | 6 |
| 62 | Install Occupancy Sensors | 0 | 42 | $6,000 | 250 |
| 63 | Install Photocell | 0 | 1 | $348 | 1 |
| 64 | Install Photocells | 0 | 1 | $695 | 2 |
| 65 | Opt Refl(4ft/1dlamp) | 0 | 96 | $72,410 | 4,963 |
| 66 | Opt Refl(4ft/2dlamp) | 0 | 195 | $84,015 | 8,032 |
| 67 | Opt Refl(8ft/1dlamp) | 0 | 10 | $2,938 | 105 |
| 68 | T-8 El Bal (4ft/2la) | 0 | 1171 | $1,186,403 | 48,267 |
| 69 | T-8 El Bal (4ft/3la) | 0 | 58 | $30,801 | 1,118 |
| 70 | T-8 El Bal (4ft/4la) | 0 | 129 | $61,031 | 2,128 |
| | | | | $4,226,551 | 212,816 |

# Calculation of the *Ex Ante* DUOM for the Military Group

**Lighting Load Impacts:**

$$Demand = \frac{Total \text{ exante } kW}{No. of \ Units} = \frac{4{,}627.44}{19{,}309.252} = 0.23964 \ kW$$

$$Energy = \frac{Total \text{ exante } kWh}{No. of \ Units} = \frac{20{,}034{,}598}{82{,}555{,}620.6} = 0.24268 \ kWh$$

# Appendix E

# Table 7
# Data Quality and Processing Documentation

# Table 7

# Data Quality and Processing Documentation for Nonmilitary End Uses

## A. Overview Information

1. **Study Title and Study ID:** 1996 Commercial Energy Efficiency Incentives Program: First Year Load Impact Evaluation, March 1998, Study ID No. 992

2. **Program, Program Year, and Program Description:** San Diego Gas & Electric offers the PY96 Commercial/Industrial/Agricultural (C/I/A) Energy Efficiency Incentives Program to help customers reduce energy costs and increase energy efficiency at their facilities. The C/I/A Energy Efficiency Incentives Program, supported through audit programs, Energy Services Representatives, and account executives, provide cost-effective DSM energy savings when existing customers have retrofit opportunities. SDG&E has three main market delivery mechanisms for providing incentives for retrofit or replace-on-burnout applications: (1) Commercial/Industrial (C/I) Incentives Program, (2) Power to Save Program, and (3) Commercial Rebates Programs. Through this marketing strategy, SDG&E is provided the flexibility needed to encourage the adoption of energy efficient measures that would not otherwise be installed by customers due to economic market barriers.

3. **End Uses and/or Measures Covered:** The end uses covered by this report are indoor lighting and space cooling.

4. **Methods and Models Used:** The main statistical model used is ordinary least squares regression analysis, applied at the customer level, for participants and nonparticipants. See the modeling section of the report for a complete discussion on the models used.

5. **Participant and Comparison Group Definition:** For the load impact analysis of the lighting and HVAC end uses, a participant was defined as a customer or a group of customers with a common contract for DSM measures who completed installation by December 31, 1996. A nonparticipant was defined as a customer who did not participate in any of SDG&E's PY96 nonresidential DSM programs. The comparison group was selected from the population of nonparticipants.

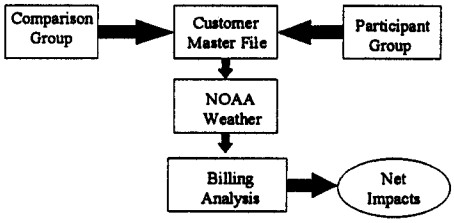
6. **Analysis Sample Size:**

| | Indoor Lighting | | HVAC | |
|---|---|---|---|---|
| | Participants | Nonparticipants | Participants | Nonparticipants |
| Study Group | 3515 | 350 | 128 | 350 |
| No. of Measures Installed | 742,347 | NA | 449 | NA |
| Avg. No. of Billing Months | 22 | 22 | 22 | 22 |

## B. Database Management

1. **Data Flow Chart:** The following diagram illustrates the relationship of the data elements used in the analysis:

Data Flow Diagram




2. **Data Sources:** Data for the impact analysis were obtained from the following major sources:

   a. Customer name, address, affected square footage, lighting hours of operation, and installation date from the program tracking database;

   b. Comparison group (nonparticipants) was selected from the Customer Master File after the participants were determined;

   c. Consumption history from the Customer Master File;

   d. Data on floor stock, square footage, hours of operation, installation of energy efficient equipment, and occupancy from on-site audits for the nonparticipant group;

   e. Hourly weather data from NOAA files for the SDG&E climate zones: Maritime, Coastal and Transitional.

3. **Data Attrition:** An attempt was made to use all participants and nonparticipants in the regression analysis.

| | Lighting | | HVAC | |
|---|---|---|---|---|
| Status | Participants | Nonparticipants | Participants | Nonparticipants |
| Starting Study Group | 4,555 | 350 | 128 | 350 |
| Special Cases Eliminated | 3,521 | NA | 70 | NA |
| Billing Data Available | 3,521 | 350 | 64 | 350 |
| Sufficient Pre/Post Data | 3,216 | 319 | 60 | 319 |

4. **Data Quality Checks:** The data sets used in the regression analysis were merged in SAS by the appropriate key variables. Counts of data before and after data merges were verified to ensure accurate merging. Surveys, billing data and other relevant information were merge by premise Id number. Weather data were merge by billing cycle and climate zone.

5. **Data Collection:** For nonparticipants, only square footage, hours of operation and installation dates of energy efficient measures were used. All other data collected was done to add to SDG&E's Commercial End Use Surveys database (CEUS) that is required for the CEC Data Collection Plan.

## C. Sampling

1. **Sampling Procedures and Protocols:** An attempt to use all program participants with the end use of interest was made. Nonparticipants were selected as described in the Overview section (p. 3).

2. **Survey Information:** The relevant survey instrument is in Appendix B. Replacements for nonparticipants for which attempts to acquire information failed were replaced with sample points that were similar in consumption size and SIC code to minimize nonresponse bias.

3. **Statistical Descriptions:**

**Lighting Energy Load Impacts**

| **Participants** | | | |
|---|---|---|---|
| | RMSE | | |
| | Satisfies RMSE Criterion | Does Not Satisfy RMSE Criterion | Grand Total |
| Total Estimated Impact (kWh per month) | -3,977,127 | 762,053 | -3,215,074 |
| Variance of Estimate | 72,052,097,276 | 18,638,827,356 | 90,690,924,631 |
| Total *Ex Ante* Estimate (kWh per month) | 3,353,309 | 642,110 | 3,995,419 |
| Modified Square Footage | 151,080,511 | 20,724,010 | 171,804,520 |
| Sample Size | 2,737 | 479 | 3,216 |
| Average Hours of Operation | 5,692 | | |
| Estimated Designated Unit of Measurement | -0.0555 | | |
| | | | |
| Realization Rate Based on *Ex Ante* Estimates | -118.6% | | |
| **Nonparticipants** | | | |
| | RMSE | | |
| | Satisfies RMSE Criterion | Does Not Satisfy RMSE Criterion | Grand Total |
| Total Estimated Impact (kWh per month) | -32,479 | 56,387 | 23,907 |
| Variance of Estimate | 1,851,451,695 | 1,050,024,599 | 2,901,476,294 |
| Total Lighted Square Footage | 5,607,613 | 723,543 | 6,331,156 |
| Sample Size | 268 | 51 | 319 |
| Average Hours of Operation | 6,337 | | |
| Estimated Designated Unit of Measurement | -0.01097 | | |
| | | | |
| Estimated Net-to-Gross Ratio | 80.2% | | |

## Space Cooling Energy Load Impacts

| **Participants** | | | |
|---|---|---|---|
| | RMSE | | |
| | Satisfies RMSE Criterion | Does Not Satisfy RMSE Criterion | Grand Total |
| Total Estimated Impact (kWh per month) | -247,976 | 47,079 | -200,897 |
| Variance of Estimate | 2,926,601,981 | 578,747,385 | 3,505,349,366 |
| Total *Ex Ante* Estimate | 242,460 | 4,249 | 246,709 |
| Sample Size | 46 | 13 | 59 |
| Modified Square Footage | 4,317,373 | 550,132 | 4,867,505 |
| Estimated Designated Unit of Measurement | -0.6892 | | |
| | | | |
| Realization Rate Based on *Ex Ante* Estimates[5] | -222.3% | | |
| **Nonparticipants** | | | |
| | RMSE | | |
| Data | Satisfies RMSE Criterion | Does Not Satisfy RMSE Criterion | Grand Total |
| Total Estimated Impact | 124,768 | 213,440 | 338,209 |
| Variance of Estimate | 1,142,258,224 | 1,973,952,774 | 3,116,210,998 |
| Total Lighted Square Footage | 4,696,591 | 996,407 | 5,692,998 |
| Sample Size | 265 | 54 | 319 |
| Estimated Designated Unit of Measurement[6] | 0.3188 | | |
| | | | |
| Estimated Net-to-Gross Ratio | 1.46 | | |

[5] The realization rate is defined as the sample ex post total estimated impacts to the sample ex ante total impacts.

[6] The realization rate is defined as the sample ex post total estimated impacts to the sample ex ante total impacts.

11. **Missing Data:** Sample points (participants and nonparticipants) that did not meet the billing data requirements were eliminated from the analysis.

12. **Precision:** Standard errors are reported in the results tables provided above.

E. **Data Interpretation and Application:**

1. **Calculation of Net Impacts:** Method A was used to determine net impacts.

2. Method A is allowed by the M&E Protocols.

# M&E PROTOCOLS TABLE 7
# DATA QUALITY AND PROCESSING DOCUMENTATION
# For 1996 Commercial Energy Efficiency Incentives Program
# Military Sector
# Interior Lighting Measures
# First Year Load Impact Evaluation
# February 1998
# Study ID No. 992

## A. OVERVIEW INFORMATION

1. **Study Title and Study ID:** 1996 Commercial Energy Efficiency Incentives Program: First Year Load Impact Evaluation, Lighting Measures, February 1998, Study ID No. 992.

2. **Program, Program Year(s), and Program Description (design):** 1996 Commercial Energy Efficiency Incentives Program for the 1996 program year. The Program is designed to help commercial customers control energy costs by providing incentives for the installation of energy efficient equipment at their facilities.

3. **End Uses and/or Measures Covered:** Commercial interior lighting.

4. **Methods and models used:** Site-specific simplified engineering with verified inputs.

5. **Participant and comparison group definition:** For the load impact analysis, the participants in the 1996 Commercial Energy Efficiency Incentives Program in the military sector are defined as having at least one of the aforementioned measures installed. A comparison group was not required for this evaluation.

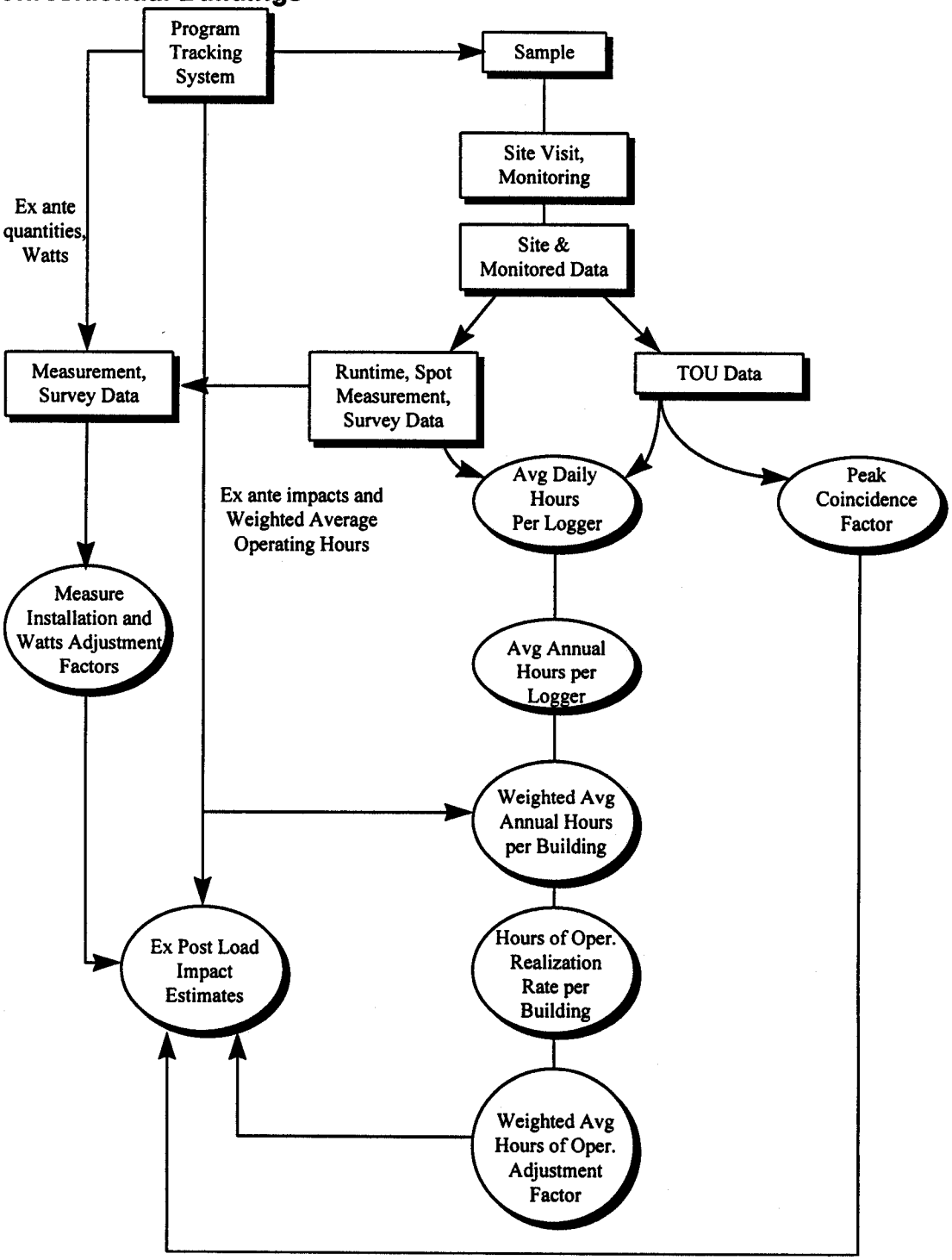
6. **Analysis sample size:**

| Electric Participant Sample for 1996 Commercial Energy Efficiency Incentives Program Military Sector | | | Gas Participant Sample for 1996 Commercial Energy Efficiency Incentives Program Military Sector | | |
|---|---|---|---|---|---|
| Measure Type | No. of Participants | No. of Measures | Measure Type | No. of Participants | No. of Measures |
| Lighting | 23 | 212,816 | Lighting | 0 | 0 |
| Total | 23 | 212,816 | Total | 0 | 0 |

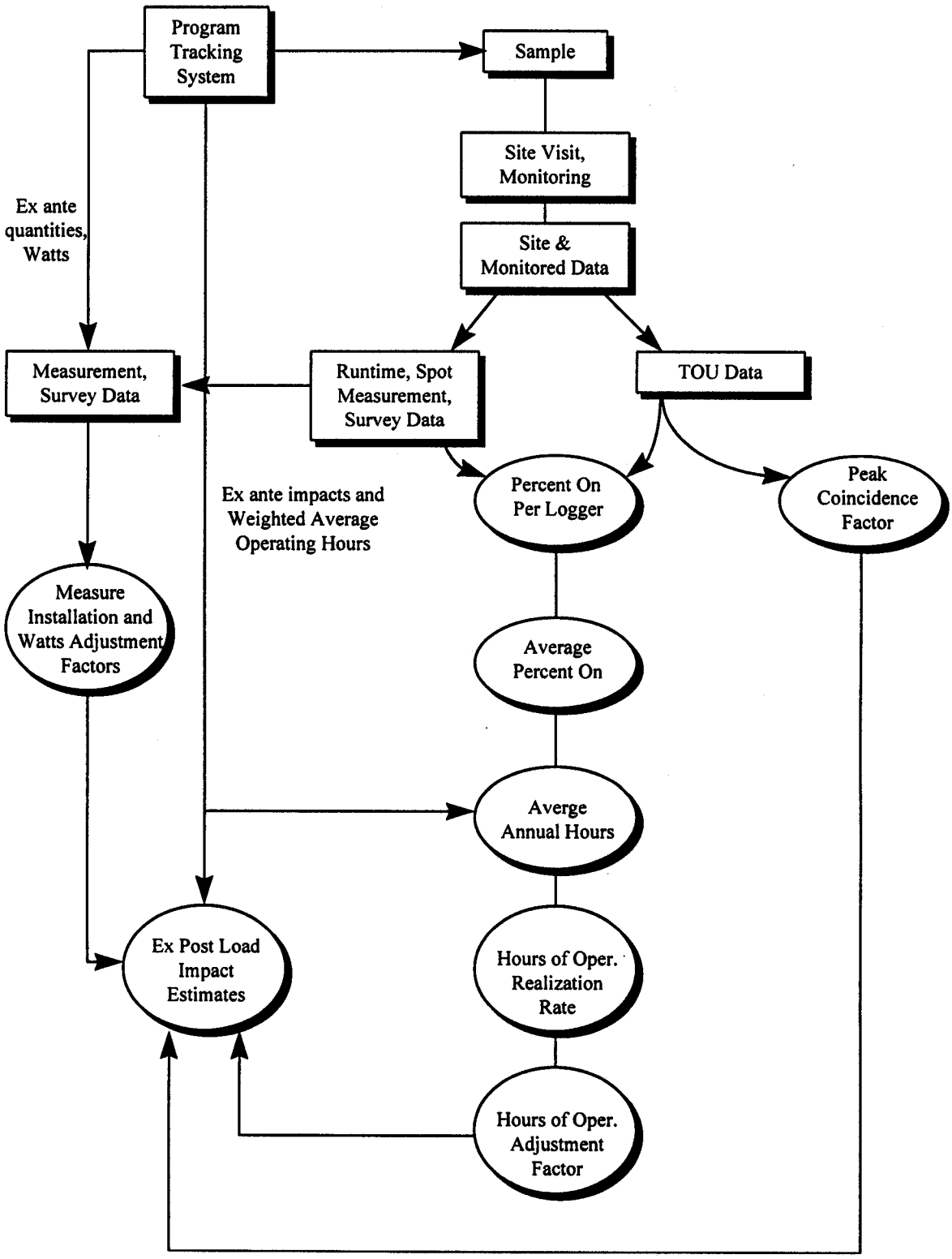
## B. DATABASE MANAGEMENT

### 1. Flow Charts:

**Nonresidential Buildings**



## Residential Units



2. **Data sources:** the data came from the following sources:

   - Customer name, address, appliance saturation, installed measures, and participation date from the program tracking database.
   - Electric and gas consumption history, where applicable, from the Customer Master File.
   - Site-specific data gathered on-site through measurements and monitoring..
   - *Ex ante* engineering assumptions and analyses from program project files.
   - *Ex post* on-site survey data.

3. **Data Attrition:**

   a. **Participant Sample - Load Impact Analysis**

   Of the total of 400 loggers installed in Family Residential Units 22 were either not damaged, removed by tenant or malfunctioned. This represents an attrition rate of 5.5 percent.

   In the Nonresidential stratum there was no attrition of loggers.

   b. **Nonparticipant Sample - Load Impact Analysis**

   Not applicable.

4. **Data Quality Checks**

   Not applicable for this evaluation.

5. **All data collected** for this analysis were utilized.

## C. SAMPLING

1. **Sampling procedures and protocols:** The participants were stratified into two strata: nonresidential buildings and family residential units. Sampling of the interior lighting measure nonresidential participants was taken to assure 70% of the total program energy and demand levels were attained per the M&E Protocols. A sample of 200 units was taken for the family residential units.

2. **Survey information:** On-site inspections of installed measures were conducted including interviews of on-site staff, and hours of operation logging of the lighting measures.

3. **Statistical Descriptions:** Not applicable.

## D. DATA SCREENING AND ANALYSIS

1. **Outliers:** Not applicable.

   **Missing data points:** Not applicable.

   **Weather adjustments**: Not applicable.

2. **"Background" variables:** Not applicable.

3. **Screening procedures:** Not applicable.

4. **Regression statistics:** Not applicable.

5. **Specification:**

   a. Not applicable.

   b. Not applicable.

   c. Not applicable.

   d. Not applicable.

   e. Not applicable.

6. **Error in measuring variables:** On-site observation of measure installation and on-site measurements were taken to mitigate possible errors from project files.

7. **Autocorrelation:** Not applicable.

8. **Heteroskedasticity:** Not applicable.

9. **Collinearity:** Not applicable.

10. **Influential data points:** Not applicable.

11. **Missing Data:** Not applicable.

12. **Precision:** Not applicable. Standard errors and other statistically based measures of precision are not applicable to the site-specific engineering analyses employed in this analysis.

## E. DATA INTERPRETATION AND APPLICATION

1. **Calculation of net impacts:** Not applicable.

2. **Processes, choices made and rationale for E.1:** Not applicable.