San Diego Gas & Electric
Marketing Programs & Planning
8306 Century Park Court
San Diego, California 92123

1995 Commercial Energy Efficiency Incentives Program

First Year Load Impact Evaluation

February 1997

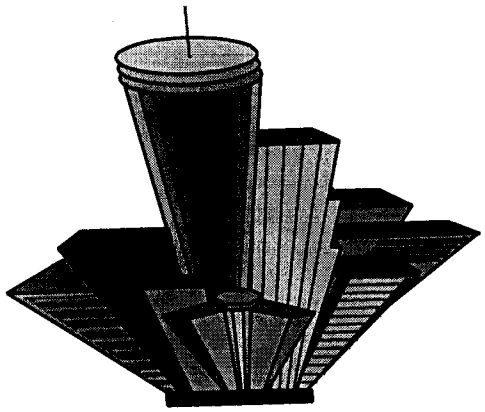

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Table of Contents

Section 1

Section 1
Executive Summary

This is an evaluation of the Program Year 1995 (PY95) 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	No. of Participants
Lighting	Nonmilitary	1159
	Military	14
	Total	**1173**
HVAC	Nonmilitary	116
	Military	1
	Total	**117**

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 PY95 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	0.35	97.2%	0.31	95.2%	89.0%
	Military	0.36	91.1%	0.21	58.8%	100.0%
HVAC	Nonmilitary	1.55	92.3%	0.0003	21.4%	97.6%
	Military	0.08	100.0%	0.00001	103.0%	100.0%

Parallel Net-to-Gross Methodology

SDG&E completed a parallel study to derive an estimate of the net-to-gross ratio for the commercial lighting end use (see Appendix D). The parallel methodology addresses the issue of self-selection directly. This study was based on a sample from the commercial customer population using a combination of survey and program data from a variety of other sources.

Since this methodology is not Protocol-approved and likely contains biases of its own, SDG&E does not intend to use this study for the purposes of adjusting the *ex ante* net-to-gross ratio. SDG&E presents this methodology as an experimental study to explore other alternative methods for deriving the net-to-gross estimate that are as yet not explicitly approved in the current M&E Protocols.

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[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.

Setion 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

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.

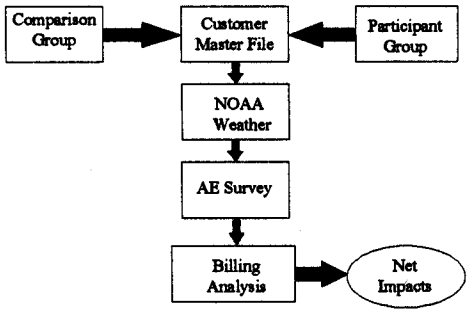
Data Collection

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;
- Information on other changes for all assigned customers in the participant and nonparticipant groups were obtained from a survey conducted on the account executives
- 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 1275 commercial customers (excluding the military bases) was identified in the 1995 commercial/industrial 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	1159
Commercial HVAC Only	116

Account Executive Survey

SDG&E conducted an internal survey of all account executives who had responsibility for customers that installed DSM measures in program year 1995. The survey was used to identify any impacts on consumption due to any changes (DSM or non-DSM) with respect to the company that may impact the way the company used energy from January 1993 through September 1995, which covers the study period. A copy of the survey instrument is in Appendix B

A total of 1777 surveys for both commercial and industrial customers were sent out to all SDG&E Marketing account executives with a cover letter explaining the survey. Two percent (31) of the commercial lighting participants were reported to have some type of change to the company (hiring, layoffs, elimination of shifts, addition of shifts, or other) or changes to equipment (HVAC, lighting, process, refrigeration, or other). Less than one percent (13) of the commercial HVAC participants were reported to have some type of change. This information was incorporated in the analyses for lighting and HVAC.

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 1995 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. Four 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	4	374	5	31	15	23
Grocery	2	1,480	20	441	74	131
Hospital	3	299	3	49	17	46
Lodging	12	503	27	218	64	53
Nursing Homes	1	50	5	43	6	21
Restaurant	9	4,709	73	1,014	22	59
School	76	745	112	219	43	67
Retail	50	8,981	64	1,048	43	252
Offices	125	25,102	82	1,488	115	383
Com'l Bldg	84	16,498	54	770	61	213
Other	12	6,441	4	255	20	150
Total	**243**	**62,834**	**449**	**5,576**	**480**	**1,398**

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 450 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 and cooling degree days are used for weather-normalization purposes in the regression models. These are the average cooling degree hours and cooling degree days covering a period of 14 years dating back to 1983.

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 1993 through October 1995. 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. The following table 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	1159	450	116	450
Billing Data Available	1110	439	107	440
Sufficient Pre/Post Data	1012	394	99	392

Discussion of M & E Issues

Revision of the Earnings Tables E-2 and 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. After conferring with the Office of Ratepayer Advocates (ORA), SDG&E agreed to update the corresponding PY95 earnings Tables E-2 and E-3 to reflect these changes. This provides consistency between the PY95 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 Tables E-2 and E-3 for the PY95 Second Earnings Claim. The revised Tables E-2 and E-3 are attached as Appendix E of this report. These tables will also be submitted in the SDG&E 1997 AEAP application.

Due to the adopted modifications to the M&E Protocols Table C-4, where the end use "combination lighting and HVAC" was eliminated for PY95, SDG&E eliminated this end use in Tables E-2 and E-3 and appropriately distributed the costs and benefits between the lighting and HVAC end uses.

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 and HVAC end uses 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	0.662	0.998	0.338	0.002
	Net				
Demand Load Impact (kW)	Gross	0.672	0.999	0.328	0.001
	Net				

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.

Parallel Net-to-Gross Methodology

SDG&E completed a parallel study to derive an estimate of the net-to-gross ratio for the commercial lighting end use (see Appendix D). The parallel methodology addresses the issue of self-selection directly. This study was based on a sample from the commercial customer population using a combination of survey and program data from a variety of other sources.

Since this methodology is not Protocol-approved and likely contains biases of its own, SDG&E does not intend to use this study for the purposes of adjusting the *ex ante* net-to-gross ratio. SDG&E presents this methodology as an experimental study to explore other alternative methods for deriving the net-to-gross estimate that are as yet not explicitly approved in the current M&E Protocols.

Section 3

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 trend term and a zero-one indicator variable (for other reported changes in monthly consumption) are included in the model, as well as an additional component based on the indicator variable d_{it}^{x}:

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

$$X_{it} = \beta_{0i} + \beta_{1i}(t) + \Delta\beta_{0i}\left(d_{it}^{x}\right)$$

Before estimating the model, customers (both participants and nonparticipants) were surveyed for any significant changes in their level of energy consumption. The indicator variable d_{it}^{x} can be appropriately defined at the customer level. This variable takes on the value 0 when there is no reported non-DSM change at the customer site. It is 1 starting from the date of a reported change. This data was gathered through the account executive survey of participants. As for the comparison group, the data was obtained both from the on-site audits and from the account executive survey. The coefficient $\Delta\beta_{0i}$ can then be estimated, allowing an adjustment to the regression for changes in expected consumption unrelated to the DSM installation under consideration.

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

Equation 3 (The Weather Portion of the Regression Equation)

$$W_{it} = \beta_{2i}(cdh_{it}) + \beta_{3i}(ch_{it})$$

The cooling degreehour variable is the sum of the cooling degrees for the corresponding normalized billing month. The cooling hours variable is the estimated number of hours for which cooling has occurred, so that the term $\beta_{3i}(ch_{it})$ represents the interaction between the lighting and space cooling end uses.

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)

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

$$S_{ijt} = \left(\gamma_{1ij} + \gamma_{2ij} cdh_{it} + \gamma_{3ij} ch_{it}\right) d_{ijt} F_{ij}$$

The term, $\left(\gamma_{1ij} + \gamma_{2ij} cdh_{it} + \gamma_{3ij} ch_{it}\right)$ 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):

$$\gamma_{1ij} = \gamma_{1i}$$
$$\gamma_{3ij}\left(\overline{ch}_i\right) = \gamma_{3i}\left(\overline{ch}_i\right)$$

given the long-term average value $\overline{ch}_i$. After a significant rearrangement of terms,

$$S_{it} = \left\{\gamma_{1i} + \gamma_{3i}\left(\overline{ch}_i\right)\right\}\left(\sum_j d_{ijt} F_{ij}\right) + \left\{\gamma_{3i}\left(\overline{ch}_i\right)\right\}\left(\frac{ch_{it}}{\overline{ch}_i} - 1\right)\left(\sum_j d_{ijt} F_{ij}\right)$$

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}^*,

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

$$S_{it} = \left\{\gamma_{1i} + \gamma_{3i}\left(\overline{ch}_i\right)\right\} k_i \left(\sum_j d_{ijt} F_{ij}^*\right) + \left\{\gamma_{3i}\left(\overline{ch}_i\right) k_i\right\}\left(\frac{ch_{it}}{\overline{ch}_i} - 1\right)\left(\sum_j d_{ijt} F_{ij}^*\right)$$

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 $\left\{\gamma_{1i} + \gamma_{3i}\left(\overline{ch}_i\right)\right\} k_i$ 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 5 (The Transformed Non-Weather/Non-DSM Portion of the Lighting Regression Equation)

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

Equation 6 (The Transformed Weather Portion of the Lighting Regression Equation)

$$W_{it} = \beta_{2i}\left(\frac{cdh_{it}}{\overline{cdh}_i} - 1\right) + \beta_{3i}\left(\frac{ch_{it}}{\overline{ch}_i} - 1\right)$$

Equation 7 (The Transformed DSM Portion of the Lighting Regression Model)

$$S_{it} = \left\{\gamma_{1i} + \gamma_{3i}\left(\overline{ch}_i\right)\right\}k_i\left(\sum_j d_{ijt}F^{*}_{ij}\right) + \left\{\gamma_{3i}\left(\overline{ch}_i\right)k_i\right\}\left(\frac{ch_{it}}{\overline{ch}_i} - 1\right)\left(\sum_j d_{ijt}F^{*}_{ij}\right)$$

where β^{*}_{0i} is the new intercept determined by the various transformations. Clearly, β^{*}_{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^{*} (taken to be December 1995).

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 $\left\{\gamma_{1i} + \gamma_{3i}\left(\overline{ch}_i\right)\right\}k_i$, generated by the regressor $\sum_j d_{ijt}F^{*}_{ij}$. This coefficient represents the monthly kWh load impact. As a result, the load impact, per square foot, per thousand hours of operation is,

Equation 8 (The Designated Unit of Measurement for Lighting Participants)

$$DUOM^{part} = \frac{(12\text{ months}) \times (1{,}000\text{ hours}) \sum_{i \epsilon part}\left\{\gamma_{1i} + \gamma_{3i}\left(\overline{ch}_i\right)\right\}k_i}{\left(\overline{hours}^{part}\right)\sum_{i \epsilon part} sqft_i}$$

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

$$\rho = -\frac{\sum_{i \epsilon part}\left\{\gamma_{1i} + \gamma_{3i}\left(\overline{ch}_i\right)\right\}k_i}{\sum_{i \epsilon part} k_i}$$

The Lighting Impact Regression for Nonparticipants

Naturally, among nonparticipants who have installed lighting measures, data is not available for obtaining *ex ante* estimates. In addition, no significant 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,

$$X_{it} = \beta_{0i}^* + \beta_{1i}(t - t^*) + \Delta\beta_{0i}\left(d_{it}^x\right)$$

$$W_{it} = \beta_{2i}\left(\frac{cdh_{it}}{cdh_i} - 1\right) + \beta_{3i}\left(\frac{ch_{it}}{ch_i} - 1\right)$$

Equation 9 (The DSM portion of the nonparticipant lighting model)

$$S_{it} = \left\{\gamma_{1i} + \gamma_{3i}\left(\overline{ch}_i\right)\right\}k_i\left(d_{it}\right) + \left\{\gamma_{3i}\left(\overline{ch}_i\right)k_i\right\}\left(\frac{ch_{it}}{ch_i} - 1\right)\left(d_{it}\right)$$

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 $\left\{\gamma_{1i} + \gamma_{3i}\left(\overline{ch}_i\right)\right\}k_i = 0$, 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. Naturally, 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 $\left\{\gamma_{1i} + \gamma_{3i}\left(\overline{ch}_i\right)\right\}k_i$ 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 1995

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 8:

Equation 10 (The Designated Unit of Measurement for Lighting Nonparticipants)

$$DUOM^{nonpart} = \frac{(12\ \text{months}) \times (1{,}000\ \text{hours}) \sum_{i \in nonpart} \left\{ \gamma_{1i} + \gamma_{3i} \left(\overline{ch}_i \right) \right\} k_i}{\left(\overline{hours}^{nonpart} \right) \sum_{i \in nonpart} sqft_i}$$

Estimation

Data

After screening for required pre-installation data (12 months) and required post-installation data (9 months), 1012 participating customers were subjected to regression analysis. The sample was further reduced, based on four other criteria. First, those customers who also had contact with the company's Nonresidential New Construction (NRNC) Program were eliminated. Second, some customers who had lighting retrofits were also associated with other aggregate retrofit contracts for which the energy savings estimates could not be disaggregated. Third, a portion of the sample did not satisfy a root-mean-squared-error (RMSE) criterion, explained in the next section. Lastly, customers whose *ex ante* savings estimate was less than 1% of the estimated normalized average monthly consumption were eliminated (1% savings criterion).

Table 7
Determination of Regression Participant Sample

Customer involved in NRNC Program	Customer involved in individual and aggregate contract	Satisfies RMSE criterion	*Ex ante* savings greater than 1% of normalized energy consumption	Commercial Sector
no	**no**	**yes**	**yes**	**660**
no	no	yes	no	168
no	no	no	yes	143
no	no	no	no	7
no	yes	yes	yes	11
no	yes	no	yes	7
yes	no	yes	yes	6
yes	no	yes	no	4
yes	no	no	yes	4
yes	yes	yes	yes	1
yes	yes	no	yes	1
Grand Total				1,012

After checking for adequate billing data, 394 participants were included in the nonparticipant sample. The sample was then reduced based on the RMSE criterion, and the availability of data on square footage and hours of operation. Table 8 gives a summary.

Table 8
Determination of Regression Nonparticipant Sample

Nonparticipant has square footage data and data on hours of operation	Satisfies RMSE criterion	Sample Size
yes	**yes**	**311**
no	no	2
no	yes	5
yes	no	76
Total		394

Estimation Methods

The model specified in Equation 1, and Equation 5-Equation 7 was estimated at the customer level for participants. To add some flexibility to the model, the exact month for the retrofit inspection was weighted out of the regression, allowing the date associated with the indicator variable to be either the month of inspection or the month prior.

Once the regressions were completed, an additional filter, the RMSE criterion, was applied. This stems from the fact that 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" (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 β_{0i}^{*}. This ratio is very likely to be large when a 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%.

Lighting Load Impact Results

Lighting Energy Load Impact Estimates

Table 9 summarizes estimated lighting energy load impacts based on the participant and nonparticipant model.

Table 9
Lighting Energy Load Impact Estimates

Savings greater than 1%	Parameter	No sqft data	Have sqft data	Grand Total
Commercial Participants				
No	Total Estimated Impact (kWh per month)	-421,067	-125,395	-546,461
	Variance of Estimate	24,446,046,140	24,066,125,661	48,512,171,801
	Total Database *Ex Ante* Estimate (kWh per month)	63,896	41,839	105,735
	Average Annual Hours	7,218	7,337	7,261
	Total Lighted Square Footage	0	2,887,994	2,887,994
	Sample Size	107	61	168
Yes	Total Estimated Impact (kWh per month)	-211,863	-2,721,973	-2,933,836
	Variance of Estimate	6,424,891,633	84,778,151,013	91,203,042,646
	Total Database *Ex Ante* Estimate (kWh per month)	597,172	2,415,086	3,012,257
	Average Annual Hours	7,635	5,261	5,901
	Total Lighted Square Footage	0	17,560,361	17,560,361
	Sample Size	178	482	660
	Load Impact (kWh per square foot, per 1,000 hours)		**-.3536**	
	Realization Rate Based On Sample *Ex Ante Estimates*	35%	113%	97%
Commercial Nonparticipants				
	Total Estimated Impact (kWh per month)		-132,027	
	Variance of Estimate		703,619	
	Average Annual Hours		5,088	
	Total Lighted Square Footage		8,031,740	
	Sample Size		311	
	Load Impact (kWh per square foot, per 1,000 hours)		**-.0388**	
Commercial Net-to-Gross			**89.0%**	

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. This peak load factor is the weighted load factor from each commercial building type. The weights were determined using the *ex ante* gross energy savings by building type reported in the PY95 program database. The load factor from each commercial building type was obtained from SDG&E's 1994 Market Segment End Use Report (September 1995). The peak load factor is the ratio of the average demand (or the total annual energy savings divided by 8760 hours) and the system coincident peak demand. The following table provides the necessary information to calculate the peak load factor

Table 10
Lighting Load Factors

Building Type	*Ex Ante* Energy Savings	Load Factor	Weight	Weighted Load Factor
Church	946,545	1.30	0.017	0.022
College	1,535,481	0.55	0.027	0.015
Stores	610,776	0.90	0.011	0.010
Grocery	2,721,399	1.00	0.048	0.048
Hospital	2,508,851	1.10	0.044	0.048
Large Office	11,832,214	0.55	0.207	0.114
Lodging	12,000,090	1.00	0.210	0.210
Nursing Home	2,284,728	0.78	0.040	0.031
Restaurant	1,091,474	1.20	0.019	0.023
Retail	6,389,951	0.43	0.112	0.048
Small Office	465,021	0.61	0.008	0.005
School	14,475,689	0.40	0.253	0.101
Warehouse	272,156	0.49	0.005	0.002
Total	57,134,375		1.000	0.677

The estimated gross demand savings is estimated by Equation 11:

Equation 11 (Estimated Participant Demand Savings)

$$\text{Est. Total Demand Savings} = \frac{(2{,}721{,}973\ \text{kWh}) * 12}{8760\ \text{hours} * 0.677} = 5{,}507.73\ \text{kW}$$

$$\text{Demand Savings (DUOM)} = \frac{1000 * 5507.73\ \text{kW}}{17{,}560{,}361\ \text{sq. ft}} = 0.314\ \text{kW per square foot}$$

with a realization rate of 95.2%.

Equation 12 (Estimated Nonparticipant Demand Savings)

$$\text{Est. Total Demand Savings} = \frac{(132{,}027\ \text{kWh}) * 12}{8760\ \text{hours} * 0.677} = 267.15\ \text{kW}$$

$$\text{Demand Savings (DUOM)} = \frac{1000 * 267.15\ \text{kW}}{8{,}031{,}740\ \text{sq. ft}} = 0.033\ \text{kW per square foot}$$

Therefore, the average net impact is 0.281 kW with a net-to-gross ratio of 89.4%.

The Space Cooling Regression Model

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

Equation 13 (The Transformed Non-Weather/Non-DSM Portion of the Space Cooling Regression Equation)

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

Equation 14 (The Transformed Weather Portion of the Space Cooling Regression Equation)

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

Equation 15 (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 16 (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 17 (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

Data

The cooling nonparticipant model can assist us in this estimation task, provided that the variable d_{it} is specified appropriately. As a result, when a nonparticipant in the database had not reportedly undertaken a space cooling retrofit, d_{it} was associated with an average installation date among participants. This was determined to be July 1995.

After screening for the required pre-installation data (12 months) and required post-installation data (9 months), 99 participating customers (customers) were subjected to regression analysis. The sample was further reduced, based on four other criteria. First, those customers who also had contact with the company's NRNC Program were eliminated. Second, some customers who had space cooling retrofits were associated with aggregate retrofit contracts for which the energy savings estimates could not be disaggregated. Third, a portion of the sample did not satisfy the root-mean-squared-error (RMSE) criterion, explained in the previous section, Estimation Methods in the Lighting section. Lastly, customers whose *ex ante* savings estimate was less than 1% of the estimated normalized average monthly consumption were eliminated.

Table 11
Determination of Regression Participant Sample

Customer involved in NRNC Program	Customer involved in individual and aggregate contract	Satisfies RMSE criterion	*Ex ante* savings greater than 1% of normalized energy consumption	Sample Size
no	**no**	**yes**	**yes**	**57**
no	no	yes	no	23
no	no	no	yes	5
no	no	no	no	2
yes	no	yes	yes	1
yes	no	yes	no	2
yes	no	no	yes	2
no	yes	yes	yes	5
no	yes	yes	no	2
Total				99

Nonparticipants were checked for sufficient billing data and for square footage data. The RMSE criterion was applied as well.

Table 12 gives a summary.

Table 12
Determination of Regression Nonparticipant Sample

Nonparticipant has square footage data	Satisfies RMSE criterion	Sample Size
yes	yes	287
no	no	13
no	yes	74
yes	no	18
TOTAL		392

Estimation Methods

The model was estimated at the customer level for participants and nonparticipants, in a way that parallels the lighting study. The 15% criterion for the ratio of the RMSE to the intercept and the 1% savings criterion described in the lighting section were imposed.

Space Cooling Load Impact Results

Space Cooling Energy Load Impact Estimates

Table 14 contains a summary of the space cooling regression results, for both participants and nonparticipants.

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. This peak load factor is the weighted load factor from each commercial building type. The weights were determined using the *ex ante* gross energy savings by building type reported in the PY95 program database. The load factor from each commercial building type was obtained from SDG&E's 1994 Market Segment End Use Report (September 1995) The peak load factor is the ratio of the average demand (or the total annual energy savings divided by 8760 hours) and the system coincident peak demand. The following table provides the necessary information to calculate the peak load factor

Table 13
Space Cooling Load Factors

Building Type	*Ex Ante* Energy avings	Load Factor	Weight	Weighted Load Factor
Church	128,100	0.29	0.006	0.002
College	41,082	0.34	0.002	0.001
Grocery	12,000,107	0.94	0.589	0.554
Hospital	2,113,313	0.29	0.104	0.030
Large Office	3,996,507	0.31	0.196	0.061
Lodging	1,318,474	0.28	0.065	0.018
Nursing Home	540	0.18	0.000	0.000
Restaurant	348,154	0.19	0.017	0.003
Retail	147,778	0.21	0.007	0.002
Small Office	85,939	0.17	0.004	0.001
School	93,929	0.23	0.005	0.001
Warehouse	103,791	0.41	0.005	0.002
Total	20,377,714		1.000	0.674

The estimated gross demand savings is estimated by Equation 18:

Equation 18 (Estimated Participant Demand Savings)

$$\text{Est. Total Demand Savings} = \frac{(233{,}870\ \text{kWh}) * 12}{8760\ \text{hours} * 0.674} = 475.33\ \text{kW}$$

$$\text{Demand Savings (DUOM)} = \frac{475.33\ \text{kW}}{1{,}813{,}584\ \text{sq. ft}} = 0.0003\ \text{kW per square foot}$$

with a realization rate of 21.4%.

Equation 19 (Estimated Nonparticipant Demand Savings)

$$\text{Est. Total Demand Savings} = \frac{(22{,}094\ \text{kWh}) * 12}{8760\ \text{hours} * 0.674} = 44.9\ \text{kW}$$

$$\text{Demand Savings (DUOM)} = \frac{44.9\ \text{kW}}{7{,}355{,}073\ \text{sq. ft}} = 0.6 \times 10^{-5}\ \text{kW per square foot}$$

The net impact is 0.0003 kW with a net-to-gross ratio of 100%.

Section 4

Section 4
Military Sector By XENERGY

1995 COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM

MILITARY SECTOR

FIRST YEAR LOAD IMPACT EVALUATION

FINAL REPORT

Prepared for

San Diego Gas & Electric
San Diego, California

Prepared by

XENERGY Inc.
San Diego, California

February 1997

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XENERGY®

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 *1995 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 *1995 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 REPORT ORGANIZATION

The remainder of this report is organized as follows:

Section 2	Results
Section 3	Study methodology

2 RESULTS

This section presents the results of the 1995 Commercial Energy Efficiency Incentives Program, military sector First Year Load Impact Evaluation.

2.1 INTERIOR LIGHTING MEASURES

This section presents the first year load impact estimates attributed to lighting measures installed in the military sector under SDG&E's 1995 Commercial Energy Efficiency Incentives Program. The *ex post* load impacts for lighting fixture measures and exit sign measures were estimated separately, then aggregated to represent the total interior lighting for the CEEI Program.

2.1.1 Lighting Fixture Measures: Gross Load Impacts

This section presents the gross *ex post* load impact estimates.

Energy Savings

The energy savings attributed to lighting measures in the military sector was estimated using an engineering model. The model took the form of:

kWh saved = (kW reduced)(operating hours)

For this evaluation the kW reduced was assumed to be known from the program tracking system. Thus, the operating hours was the unknown variable for estimating the kWh savings. Because the operating hours became the only unknown variable in the equation, any variance in the operating hours will be directly reflected in the energy savings estimation. *Ex post* data on the operating hours were gathered for buildings that were part of the 1995 CEEI Program. A realization rate for the operating hours estimated in accordance with Table 6 of the *M&E Protocols* was estimated. The equation for the realization rate is:

$$R = \frac{H_{ex\ post}}{H_{ex\ ante}},$$

where,

R = *Realization rate,*

$H_{ex\ post}$ = *Hours estimated through ex post monitoring, and*

$H_{ex\ ante}$ = *Ex ante hours from tracking system.*

A realization rate was estimated for each building evaluated. The program realization rate was calculated by taking the weighted average of the evaluated buildings. The weights were based on the *ex ante* energy savings for each building.

A total of 266 buildings were evaluated. The gross realization rate for operating hours was 0.879.

This realization rate was applied to the *ex ante* gross energy savings to estimate the *ex post* energy savings for the program. The gross energy impacts are shown in Table 2-1.

Table 2-1
***Ex Post* Gross Energy Impacts**
Military Sector Lighting Fixture Measures

***Ex ante* gross kWh savings**	40,403,416 kWh
Realization rate	0.879
***Ex post* gross kWh savings**	35,514,603 kWh

Demand Reduction

The demand reduction attributed to lighting measures was estimated by evaluating the time-of-use light loggers in the field on the day of SDG&E's system peak for 1996. The date and time were August 29, 1996 at 3:00 p.m.

Table 2-2 shows the *ex post* demand impact estimate.

Table 2-2
***Ex Post* Gross Energy Impacts**
Military Sector Lighting Fixture Measures

Number of TOU light loggers in field on August 29, 1996	147
Percent of loggers on during the system peak hour	44.7%
***Ex ante* gross kW reduced**	10,168 kW
Adjusted for M&E adjustment factor (0.76)	13,379 kW
***Ex post* gross kW reduced**	5,980 kW

2.1.2 Net-To-Gross

The net-to-gross ratio for the military sector was determined through an interview with a key decision maker representing the military. Several key points were raised during the interview:

- **SDG&E committed significant resources to meet the needs of the military.** SDG&E had invested time and resources to develop an infrastructure to assist the military in meeting its energy efficiency needs. Support was provided to the military in the form of audits, assistance in providing documentation to the military for funding, preparation of implementation bid solicitation, and project management. The assignment of key account

representatives to the U.S. Navy and Camp Pendleton allowed them to focus their efforts in identifying and facilitating the implementation process. 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.

- **SDG&E worked closely with the military.** SDG&E worked closely with the military to understand the requirements of the military both locally and nationally. By understanding these requirements, SDG&E was able to provide the assistance necessary to enable the local efforts to be completed in a timely fashion, thereby facilitating and, in some cases, enabling the implementation process.
- **Without SDG&E's support, the implementation would have been delayed.** Without SDG&E's support, the installation of energy efficiency measures would have been delayed. It is uncertain how long, at least one year, but based on the interviewee's recent experience with another utility, the delay could have been significantly longer. For example, the completion of the audits, funding requisitions, request for bids, bidder selection, construction management, and quality control would have offered many opportunities for time lost.
- **Disproportionate share of federal funding obtained for the San Diego area.** Due to the number and magnitude of the energy efficiency project funding requests received at the federal level, the San Diego area received a disproportionately high share of funding for its energy efficiency projects. This is largely due to the ability demonstrated by SDG&E's systems to complete the audits and feasibility studies and to prepare the required documentation for funding requisitions.
- **Program incentives were a great motivator.** In addition to the support provided by SDG&E, the financial incentives were a great motivator to reduce the military's costs and to improve the position of the projects within the military's funding priority.

A net-to-gross ratio of 1.0 has been assigned to the military sector energy efficiency program. This assignment is based on the following:

- Extensive support infrastructure developed to facilitate military energy efficiency projects.
- Likelihood the projects would not have been completed in a timely fashion without SDG&E's support.
- The close working relationship between the military and SDG&E during 1995.

2.1.3 Net Impacts

As shown in Table 2-3 the net load impacts are the same as the gross load impacts.

Table 2-3
***Ex Post* Gross Energy Impacts**
Military Sector Lighting Fixture Measures

	kWh Savings	kW Reduction
***Ex post* gross load impacts**	35,514,603 kWh	5,980 kW
Net-to-gross ratio	1.00	1.00
***Ex post* net load impacts**	35,514,603 kWh	5,980 kW

2.1.4 Exit Sign Measures

Each of the building monitored was surveyed for the presence of the LED exit signs installed as part of the exit sign program conducted at Navy facilities during 1995. Virtually every building in the San Diego area was included in the program. It was estimated that load impacts of the exit sign program for military facilities were the same as it was on the program tracking system. These are shown in Table 2-4.

Table 2-4
***Ex Post* Energy Impacts**
Military Sector Exit Sign Measures

***Ex post* kWh Saved**	3,345,725
***Ex post* kW Reduced**	383.12

2.1.5 Interior Lighting Measure Impacts

The interior lighting measure impacts for the military sector is the aggregate of the lighting fixture measures and exit sign measures. Table 2.5 presents the aggregated load impacts for the interior lighting measures.

Table 2-5
***Ex Post* Load Impacts**
Interior Lighting Measures
Military Sector

		kWh Savings	kW Reduction
Gross impacts	Lighting fixture measures	35,514,603	5,980
	Exit sign measures	3,345.725	383
	Total gross load impacts	38,860,328	6,363
Net impacts	Net-to-gross ratio	1.00	1.00
	Ex post net load impacts	38,860,328	5,980 kW
Gross Realization Rate		0.911	0.588

2.1.6 Load Impacts By The Designated Unit Of Measurement (DUOM)

The load impacts by the designated unit of measurement (DUOM) are shown in Table 2-6. The DUOM for interior lighting is calculated as:

$$DUOM_{kWh} = \frac{(1000\ hours)(kWh\ saved)}{(Average\ operating\ hours)(Square\ feet)}$$

$$DUOM_{kW} = \frac{(1000\ hours)(kWh\ saved)}{(Square\ feet)}$$

The total square feet was 28,066,833 square feet. The *ex post* average operating hours was 3,813 hours per year.

Table 2-6
Load Impacts By DUOM
Interior Lighting
Military Sector

DUOM	*Ex Ante*	*Ex Post*
kW Reduced	0.362	0.213
kWh Saved	0.361	0.363

2.2 HVAC MEASURES

The two HVAC measures installed for the military in 1995 were for a brig (military prison. The brig which operates 24 hours per day, 7 days per week, 52 weeks per year (8,760 hours per year).

A 5 Ton DX AC unit needed to be replaced. Instead of replacing the unit with a standard 10 SEER unit, a 12.25 SEER unit with an economizer was installed. This installation was verified by SDG&E staff on 2/14/95.

The savings of the DX AC is a direct result of the increased efficiency of the compressor. The economizer achieves savings by allowing outside air to act as a direct source of cooling when outdoor temperatures permit. This in turn reduces the amount of time that the DX AC compressor has to operate.

2.2.1 Analytical Approach

Local weather and manufacturer's performance data were considered to calculate the coincident demand and annual energy consumption for the baseline and retrofit configurations.

The baseline for comparison is a 5 Ton, 10 SEER DX AC unit without an economizer.

The results of a simplified engineering analysis are shown in Table 2-7.

Table 2-7
Demand and Energy Impact Summary
HVAC Measures
Military Sector

	Demand (kW/Year)	Energy (kWh/Year)	Gas (Therms/Year)
Ex ante estimated gross impacts	1.10	5,955	N/A
Ex post estimated gross impacts	1.10	6,116	N/A
Difference	0	-161	N/A
Realization rate	1.00	1.03	N/A

The facility was 74,462 square feet in size. The DUOM for the HVAC measures are show in Table 2-8.

Table 2-8
DUOM for HVAC Measures
Military Sector

	DUOM
kW	0.00001
kWh	0.08214

3 METHODOLOGY

3.1 INTRODUCTION

This section describes the approach used to estimate the *ex post* load impacts for SDG&E's Commercial Energy Efficiency Incentives (CEEI) Program for measures installed in the military sector. 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 Energy Efficiency Incentives 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 CEEI Program.

3.2 SAMPLE DESIGN

As allowed by the retroactive waiver for measures installed in the military sector were evaluated using Table C-5 of the *M&E Protocols*. The sampling methodology applied to these participants is consistent with the *M&E Protocols* for the industrial sector.

Key characteristics of the sampling methodology include:

- For lighting measures surveyed represented 70% of the energy savings for lighting measures installed in the military sector; and
- For HVAC measures a census was attempted.

Table 3-1 shows pertinent statistics of the 1995 CEEI Program in the military sector. As can be seen, over 10,400 individual measure records were installed in over 1,900 buildings. These measures had *ex ante* electricity savings of almost 45 GWh's and over 10 MW in demand reduction. Of these electric impacts, approximately 90 percent of the energy and 95 percent of the demand impacts were from lighting measures.

Table 3-1
SDG&E's Commercial EEI Program
Military Sector
1995 Program Statistics

	Lighting	HVAC	Exit Signs	Total
Number of Measures	9,896	4	506	10,406
Energy Savings (kWh)	40,403,416	1,164,721	3,345,725	44,913,862
Demand Reduction (kW)	9,787	143	383	10,312
Therm Savings	0	253,413	0	253,413
No. of Buildings	1,900	3	N/A (See Note 1)	1,903

Note 1: The exit sign installations were performed on virtually all buildings on each base throughout the Greater San Diego Area. Data were not maintained on a building-specific basis in the tracking system.

3.2.1 Sample: Interior Lighting Measures

The lighting measures evaluated was comprised of two broad types of measures:

- lighting fixtures; and
- LED exit signs

These two types of measures were evaluated differently. The samples are described in the following subsections.

Lighting Fixture Measures

The sample for lighting measures was selected at the building level, 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 1,900 building were sorted in order of load impacts. The buildings with the greatest consumption were selected until the cumulative total of those selected reached the 70% threshold.

Building type was used as a secondary selection criteria, based on the assumption that lighting usage may vary due to the varying activities within the buildings. Building type provided a relatively homogeneous segmentation variable.

A total of 232 buildings were selected for the sample. These buildings accounted for 28.1 GWh, 70% of the total of 40.4 GWh.

Buildings included in the study accounted for 28.1 GWh. A total of 266 buildings were studied. The reason for the difference in the original sample and the final sample was due to the limited access to some buildings. Additional buildings were drawn from the participant lists to replenish the sample.

Sample: Exit Sign Measures

During 1995, the U. S. Navy and SDG&E embarked on a large scale exit sign retrofit project where virtually every exit sign on each military base in the San Diego area was retrofit with energy efficient LED units. The project was implemented on a base-by-base basis. Records in the tracking system were entered as groups within a base making sampling by building virtually impossible.

To address the exit sign measures through this study, the buildings included in the sample for lighting measures were surveyed for installation of LED exit signs. This approach allowed us to include a broad cross section of military bases throughout the San Diego area in the study.

3.2.2 Sample: HVAC Measures

A census of the two HVAC measures were included in this First Year Impact Evaluation. These two measures, an high efficiency direct expansion air conditioner (DX AC) and an economizer on a 5-ton DX AC unit, were installed in a brig (military prison). These measures represented 5,955 kWh and 1.1 kW in *ex ante* load impacts.

3.3 LIGHTING *EX POST* LOAD IMPACT ESTIMATION

This section describes the approaches used to estimate the load impacts of lighting fixture measures and exit sign measures.

3.3.1 Lighting Fixture Measures

The basic approach to the estimation of *ex post* load impacts for the military sector lighting measures was to verify the installation of the measures and estimate the hours of operation *ex post*. The *ex post* hours of operation were used to estimate the *ex post* energy savings. The hours of operation was estimated primarily through the monitoring of light fixtures through light loggers. For a small portion of the study sample, twelve buildings, the hours of operation were gathered through interviews of site personnel, as the installation of loggers was not permitted due to security issues.

Figure 3-1 shows the data flows used in the evaluation.

Data Collection

The installation of light loggers was started in June 1996 and ended in January 1997. Most loggers were installed for a period of two to four weeks, however, some loggers were installed for as long as five to six months.

Each of the military bases was visited and light loggers were installed in the sample buildings. The light loggers were installed in the retrofitted fixtures in a variety of room types within each building so that a weighted average hours of operation based on room type could be estimated. The location of the logger, logger identification number, and the date and time of installation were noted to facilitate logger pick up.

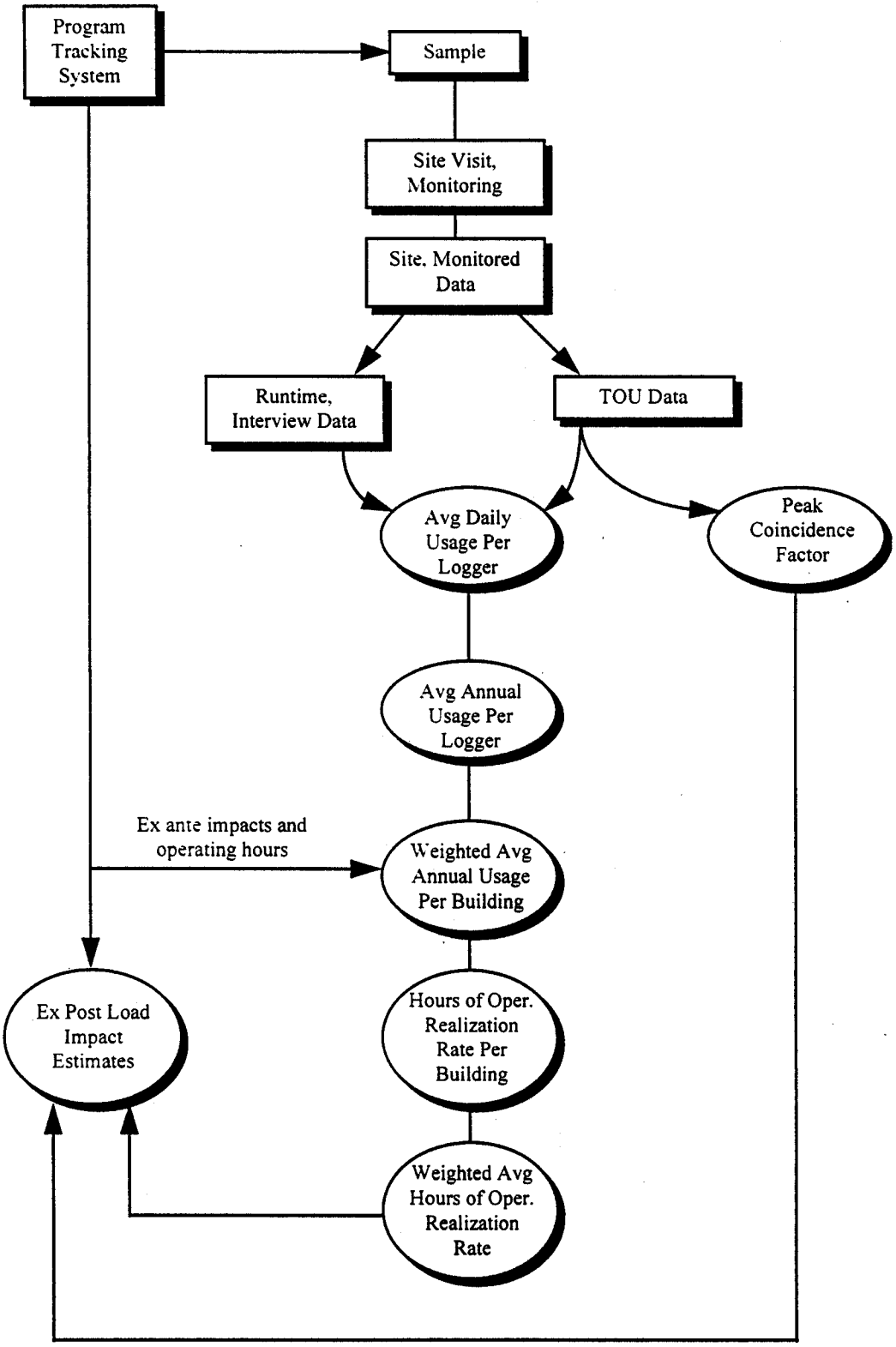
After retrieval, the data from the loggers were downloaded and entered into the database for analysis. Approximately half of the loggers were capable of recording lighting usage on a time-of-use basis. The other half were simple run-time loggers. In addition to the hours of operation, the time-of-use loggers were used to calculate the peak coincident factor for estimating peak demand reduction.

Gross Ex Post Load Impacts

This section describes the estimation of the realization rate for hours of operation for the military lighting measures.

The average hours of operation per day was determined for each logger. Weights for each logger were estimated based on estimates of the number measures installed in each room type in the building. For example, a logger installed in a resident room in a barracks, which comprises a large share of the building, would receive a larger weight than a game room in the same building. These weights were then applied to the average daily hours of operation to estimate the average daily hours for the building, that were annualized.

Figure 3-1
Military Sector Lighting Evaluation Data Flow



A realization rate for the hours of operation was estimated for each building using Equation 3-1.

(Eq. 3-1)

$$R = \frac{H_{ex\ post}}{H_{ex\ ante}},$$

where,

R = *Realization rate,*

$H_{ex\ post}$ = *Hours estimated through ex post monitoring, and*

$H_{ex\ ante}$ = *Ex ante hours from tracking system.*

An aggregate realization rate was calculated by taking a weighted average of the building realization rates. The weights were based on the *ex ante* energy savings for the building.

To estimate the *ex post* gross energy savings, the realization rate for the hours of operation was applied to the *ex ante* gross energy savings. This required the assumption that the hours of operation was the primary unknown variable in determining energy savings. This is a reasonable assumption since the installation of the measures were verified and that past studies have indicated that the hours of operation is the has a major affect on the load impacts of lighting retrofit measures, as compared to the demand reductions. Another way of saying this is that the demand reduced is assumed to be known from the tracking system.

Demand impacts were estimated by evaluating the status of the time-of-use light loggers that were in the field at the time of the system peak for SDG&E's system in 1996. The system peak took place on August 29, 1996 at 3 p.m. The share of loggers that were on during that hour was applied to the *ex ante* demand impacts, which were assumed to be a known from the tracking system to estimate the demand reductions. The tracking system demand reduction was adjusted first by dividing by the M&E adjustment factor of 0.76 that was used to adjust the simple difference in connected demand reduction attributed to the retrofit. The *ex post* demand reduction was then estimated.

3.3.2 Exit Sign Measures

During 1995, the U. S. Navy and SDG&E embarked on a large scale exit sign retrofit project where virtually every exit sign on each Navy base in the San Diego area was retrofit with energy efficient LED units. The project was implemented on a base-by-base basis. Records in the tracking system were entered as groups within a base making sampling by building virtually impossible.

To address the exit sign measures through this study, the buildings included in the sample for lighting measures were surveyed for installation of LED exit signs. This approach allowed us to include a broad cross section of military bases throughout the San Diego area in the study. The *ex post* load impacts were estimated by scaling the *ex ante* load impacts based on the installation rates of the measures.

3.4 HVAC *Ex Post* Load Impact Estimation

As described in Section 3.2.2, the two measures with a total *ex ante* load impact of 5,955 kWh and 1.1 kW were included in the evaluation. This represented a census of HVAC measures for the military sector. Access to the facilities was denied since the building was a brig (military prison). An engineering review of the project files was conducted.

3.5 Net-to-Gross

To determine the effect the CEEI Program had on the installation of these measures in the military sector an interview was conducted with the key decision maker for the military. The installations involved were all considered to be under the domain of the Southwest Division of the U.S. Navy. In essence, a single office was managing these efforts for the military. The interview was conducted to determine the level of assistance and the extent that the program affected the military's decision or ability to install these measures. A net-to-gross ratio was estimated based on the interview.

Appendix F

Appendix F

Table 6
Results Used to Support PY95 Second Earnings Claim

SAN DIEGO GAS & ELECTRIC

M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY95 SECOND EARNINGS CLAIM FOR THE COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM

FIRST YEAR LOAD IMPACT EVALUATION, FEBRUARY 1997, STUDY ID NO. 959

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:	Pre-install kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pre-install kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	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
	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:	Impact Yr kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Impact Yr kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	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
	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. i. Load Impacts - kW	2.26	2.11	-1.11	5.63	-1.37	5.58	-0.36	4.89	-0.60	4.81
	A. ii. Load Impacts - kWh	75,850	74,926	55,945	95,754	54,423	95,428	60,337	91,362	58,948	90,904
	B. i. Load Impacts/designated unit - kW	0.0031	0.0031	0.0030	0.0033	0.0029	0.0033	0.0030	0.0033	0.0031	0.0032
	B. ii. Load Impacts/designated unit - kWh	1.55	1.51	1.14	1.95	1.09	1.93	1.23	1.86	1.19	1.84
	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	24.8%	25.6%	-12.1%	61.7%	-16.6%	67.9%	-4.0%	53.5%	-7.3%	58.6%
	D.A. ii. Load Impacts - kWh, realization rate	89.2%	97.9%	65.8%	112.6%	71.1%	124.7%	70.9%	107.4%	77.0%	118.8%
	D.B. i. Load Impacts/designated unit - kW, real rate	224.7%	243.8%	224.7%	224.7%	228.6%	259.0%	224.7%	224.7%	231.9%	255.7%
	D.B. ii. Load Impacts/designated unit - kWh, real rate	106.7%	115.8%	77.9%	135.6%	84.7%	146.9%	84.2%	129.2%	91.6%	140.1%
3. Net-to-Gross Ratios		RATIO		RATIO	RATIO			RATIO	RATIO		
	A. i. Average Load Impacts - kW	93.1%		86.6%	99.6%			88.0%	98.1%		
	A. ii. Average Load Impacts - kWh	98.8%		92.3%	105.3%			93.7%	103.8%		
	B. i. Avg Load Impacts/designated unit of measurement - kW	97.7%		1.4%	193.9%			22.7%	172.7%		
	B. ii. Avg Load Impacts/designated unit of measurement - kWh	97.7%		1.4%	193.9%			22.7%	172.7%		
	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	49,016	25,627	30,484	67,548	21,269	29,986	34,573	63,459	22,231	29,024
6. 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.

SAN DIEGO GAS & ELECTRIC

M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY95 SECOND EARNINGS CLAIM FOR THE COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM

FIRST YEAR LOAD IMPACT EVALUATION, FEBRUARY 1997, STUDY ID NO. 959

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. 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:	Pre-install kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pre-install kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	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
	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:	Impact Yr kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Impact Yr kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	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
	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. i. Load Impacts - kW	11.43	10.57	9.42	13.44	8.56	12.58	9.86	12.99	9.00	12.13
	A. ii. Load Impacts - kWh	67,767	67,342	55,842	79,692	55,418	79,267	58,474	77,060	58,049	76,636
	B. i. Load Impacts/designated unit - kW	0.31	0.28	0.31	0.31	0.28	0.28	0.31	0.31	0.28	0.28
	B. ii. Load Impacts/designated unit - kWh	0.35	0.31	0.29	0.41	0.25	0.37	0.30	0.40	0.26	0.36
	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	85.9%	93.5%	70.8%	101.1%	75.7%	111.3%	74.2%	97.7%	79.6%	107.4%
	D.A. ii. Load Impacts - kWh, realization rate	127.0%	146.7%	104.6%	149.3%	120.7%	172.7%	109.5%	144.4%	126.5%	166.9%
	D.B. i. Load Impacts/designated unit - kW, real rate	95.2%	98.7%	95.2%	95.2%	98.6%	98.7%	95.2%	95.2%	98.6%	98.7%
	D.B. ii. Load Impacts/designated unit - kWh, real rate	97.2%	100.5%	79.9%	114.5%	80.4%	120.5%	83.7%	110.7%	84.8%	116.1%
3. Net-to-Gross Ratios		RATIO		RATIO	RATIO			RATIO	RATIO		
	A. i. Average Load Impacts - kW	92.5%		91.2%	93.8%			91.4%	93.5%		
	A. ii. Average Load Impacts - kWh	99.4%		96.0%	100.7%			98.3%	100.4%		
	B. i. Avg Load Impacts/designated unit of measurement - kW	89.3%		88.0%	90.5%			88.3%	90.2%		
	B. ii. Avg Load Impacts/designated unit of measurement - kWh	88.9%		87.6%	90.1%			87.9%	89.8%		
	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	36,432	25,826	31,298	41,567	21,639	30,012	32,431	40,434	22,563	29,088
	B. Post-install average value HOURS OF OPERATION	5,261	5,088	5,122	5,400	4,883	5,293	5,153	5,369	4,928	5,248
6. 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.

SECTOR=COM STUDY=HVAC

OBS	NEW_DESC	NEW_QTY	CUST_CST
1	ASD on AH Fan Motor	1	$9,487
2	Economizers Repair	2	$2,125
3	high efficiency package terminal A/C and heating u	3	$2,933
4	install CO monitor to control ventilation fan oper	10	$13,718
5	A/C: DX High Efficiency Unit	41	$5,986
6	A/C: DX High Efficiency Unit-package terminal A/C	1	$1,000
7	A/C: DX<5.4 ton	1	$255
8	AFD for Chiller	1	$55,168
9	AFD for Condenser Water Pump	1	$4,139
10	ASD on Air Handler	8	$7,386
11	ASD on Air Handler Fan	1	$6,000
12	ASDs on Air Handlers	13	$67,482
13	ASDs on Cooling Tower Fan Motors	2	$17,745
14	Carbon Monoxide Control System to control Ventilat	4	$10,186
15	Carbon Monoxide Sensor	1	$6,548
16	Chiller w/ High Efficiency Microprocessor	1	$7,780
17	Condenser Water Reset for Cooling Tower/Chiller	1	$19,784
18	Convert Cooling to Chilled Water System	1	$91,456
19	Cooling System Tower w/Pony Motor	1	$7,700
20	CO monitor	3	$4,880
21	CO monitor to control ventilation fan operation	4	$5,910
22	CO monitoring system	1	$8,956
23	CO monitors to control ventilation fan operation	4	$1,240
24	CO Monitor	1	$8,043
25	CO Monitoring System	1	$40,063
26	CO Monitors and Controls for Exhaust Fans	2	$4,262
27	CO Sensor	3	$6,388
28	CO Sensor- CO monitor to control ventilation fan o	2	$3,664
29	CO Sensor-Carbon monoxide sensors to control venti	5	$7,241
30	CO Sensors for fans	3	$4,224
31	CO2 Monitor to control vent fans	2	$3,462
32	CO Monitoring System (4 Sensors on 2x7.5HP Fans)	4	$6,210
33	Economizer	1	$1,000
34	Economizer on New Unit	1	$1,200
35	Economizer on 5 Ton A/C Unit	1	$725
36	Economizer on 7.5 Ton A/C Unit	1	$755
37	Economizer Installation	26	$2,825
38	Economizer Installation - to air-source heat pumps	1	$550
39	Economizer Installation- to 2 (3.5)Ton heat pump	2	$1,100
40	Economizer Repair	1	$450
41	Economizer Repair on HVAC Units	9	$3,579
42	Electronic/DDC Economizer Control System	2	$96,909
43	Energy Efficient A/C System	1	$38,900
44	Energy Efficient Chiller	1	$3,202
45	EMS for lighting, HVAC, and kitchen equipment	36	$234,000
46	Heat Pump	2	$13,146
47	Heat Pump: AirSrc 24-65 MBH	12	$11,035
48	Heat Pump:WaterSrc >135 MBH	2	$1,324
49	Hi Eff Centrifugal Chillers (2x300HP)	2	$151,330
50	Hi Eff Chiller with Turbo Modulator	1	$116,000
51	Hi Eff Water Cooled Rotary Screw Chillers	2	$56,260
52	High Efficiency Wall Air Conditing Units	10	$4,800

SECTOR=COM STUDY=HVAC (continued)

OBS	NEW_DESC	NEW_QTY	CUST_CST
53	Install CO Monitor to control vent fan	5	$7,642
54	Install CO Sensors to control ventilation fan oper	1	$15,120
55	Install CO2 Monitor to control ventilation fans	3	$3,995
56	Install Economizer	1	$10,000
57	Install Economizer on Air Handler	1	$5,420
58	Install Energy Management System	1	$23,580
59	Modify Piping & Controls for additional	1	$9,525
60	Motor 1HP - 2HP	13	$80
61	Motor 15HP - 50HP	35	$455
62	Motor 3HP - 10HP	24	$150
63	Motor 60HP - 200HP	5	$1,281
64	New Electronic Controls for Economizers/DDC System	1	$130,102
65	New High Efficiency Exhaust System	1	$20,945
66	New Induced Draft Cooling Tower with ASD	1	$18,122
67	Replace existing 4 ton 10 SEER pkged units w 4 ton	2	$1,360
68	Replace existing 4-Ton pkged unit with 4-Ton SEER	1	$680
69	Replace linkages, sensors and connect to DDC contr	1	$55,886
70	Scroll Chiller (40Ton) & Screw Chiller (157 Ton)	2	$114,500
71	Subdivide Air Conditioning Zones,Shut Down AH	1	$5,762
72	Tinted Glazing	1	$9,534
73	Twenty Three Zone Air 3/4 ton air conditioning uni	23	$11,281
74	VAV Control on 2 Lab Fume Hoods	2	$18,848
75	VFDs on Air Handlers	18	$79,069
76	VFDs on CWP 5 & Air Handlers 4	2	$17,560
77	VSD's on 1x40 & 1x60HP chilled wtr pumps	2	$30,500
78	VSDs for Air Handlers	3	$14,206
79	1 3-Ton 12 SEER split system A/C unit	1	$2,191
80	15-Ton package unit	1	$1,111
81	2 Speed Drive for Cooling Tower Fan	1	$400
82	2.5 ton split system	4	$5,895
83	2-ton SEER Gas & Electric unit	1	$340
84	2-Ton 12 SEER A.C. Package unit	1	$340
85	2x10HP,11x15HP,1x25HP ASD on Air Handlers	14	$62,913
86	3 ton packaged units	4	$2,040
87	3 ton split system	4	$5,895
88	365 Day Timeclock Fan Coil System	3	$390
89	5 Ton 12SEER Heat Pump	1	$940
90	5-ton 11 SEER heat pump	15	$48,000
91	7.5 Ton 10EER A/C Heat Pump	1	$6,712
92	7-2.5 ton packaged units	7	$2,975

SECTOR=COM STUDY=LIGHTING

OBS	NEW_DESC	NEW_QTY	CUST_CST
93	ceiling mounted occupancy sensors	5	$120
94	ceiling mounted ultra-sonic occupancy sensor	3	$72
95	install occupancy sensors	116	$1,392
96	occupancy sensor	632	$286
97	wall mounted occupancy sensor	3	$36

SECTOR=COM STUDY=LIGHTING
(continued)

OBS	NEW_DESC	NEW_QTY	CUST_CST
98	wall mounted occupancy sensors	10	$120
99	Case Lighting Controls (Midnight to 6AM	20	$126,348
100	Compact fluorescents	80	$6,044
101	Current Limiter 96" 2 lamp/fixture	572	$6,602
102	Current Limiter 96" 2 lamps/fixture	1,565	$9,032
103	CF-13Q Hardwire Fxt	2,398	$666
104	CF-13Q Hardwire Fxtr	7,764	$985
105	CF-7 Hardwire Fxtr	727	$1,212
106	CF-9 Hardwire Fxtr	216	$771
107	CO monitor to control ventilation fan operation	1	$4,947
108	Delamp (2 ft)	2,015	$-356
109	Delamp (4 ft)	26,569	$246
110	Electronic Bal (8ft)	2,142	$1,226
111	Exit Sign Kit (LED)	26,273	$-1,530
112	Exit Sign 14W CF	607	$-1,083
113	Exit Sign 20W CF	314	$-1,868
114	F30/B3-ST/2DLAMP3	2	$-87
115	F72/B6-ST/2DLAMP6	1	$10
116	Hybrid Bal (4ft/2la)	334	$340
117	Infrared Motion Sensor Light Switch	1	$24
118	Install occupancy sensor	8	$24
119	Install occupancy sensors	34	$204
120	Install timeclock	1	$4,000
121	Install timeclocks	7	$4,800
122	Install Motion Sensors	16	$384
123	Install Occupancy S	776	$621
124	Install Occupancy Sensor	1	$24
125	Install Occupancy Sensors	742	$524
126	Install OC to control the lighting	5	$120
127	Install OS to control lighting	2	$48
128	Install Twist Timer	5	$210
129	Install 1 ceiling mounted occupancy sensor	1	$24
130	Installed occupancy sensor	1	$24
131	Intall Twist Timers to control lighting in storage	3	$105
132	LED Exit Signs-Single Face	49	$-2,593
133	Occupancy Sensors	2,623	$362
134	Occupancy Sensors - Wall mounted	51	$1,224
135	Occupancy Sensors in Restrooms	6	$144
136	Occupancy Sensors-	1	$24
137	Occupancy Sensors-conf room,breakroom	2	$48
138	Occupancy Sensors-one in each restroom	7	$168
139	Occupancy Sensors-Wall Stoppers	85	$2,040
140	Occupancy Sensors/offices	4	$96
141	Opt Refl(2ft/1dlamp)	7,762	$1,208
142	Opt Refl(4ft/1dlamp	2,047	$2,077
143	Opt Refl(4ft/1dlamp)	27,292	$2,327
144	Opt Refl(4ft/2dlamp	2,076	$2,042
145	Opt Refl(4ft/2dlamp)	29,070	$1,835
146	Opt Refl(8ft/1dlamp)	157	$966
147	Photo Cells	30	$500
148	Retrofit with High Pressure Sodium Lighting	30	$-2,118

SECTOR=COM STUDY=LIGHTING
(continued)

OBS	NEW_DESC	NEW_QTY	CUST_CST
149	Retrofit High Pressure Sodium Lighting	62	$-4,376
150	Sensor: Photocell to control 20W ceiling fluoresce	1	$47
151	Sensor: Twist Timers	4	$60
152	T-8 El Bal (4ft/2la	24,886	$1,677
153	T-8 El Bal (4ft/2la)	127,570	$1,836
154	T-8 El Bal (4ft/3la	1,459	$1,627
155	T-8 El Bal (4ft/3la)	8,502	$1,416
156	T-8 El Bal (4ft/4la	4,867	$1,205
157	T-8 El Bal (4ft/4la)	26,446	$1,010
158	Twist Timers	39	$1,642
159	Twist Timers/Lighting	8	$47
160	0F72/0B6-ST	2	$19
161	1CC32H	51	$1,206
162	1CE21S	22	$418
163	1CE22S	4	$-7
164	1CE30H	12	$488
165	1CE30H/B4-ST	3	$249
166	1CFQE15S/1B-COMPCT	10	$514
167	1CFQE18H	27	$1,294
168	1CFQE18H/1B-COMPCT	12	$357
169	1CFQE23H	5	$330
170	1CFQ13H	1,773	$1,040
171	1CFQ13H/1B-COMPCT	571	$2,139
172	1CFQ13S	8	$173
173	1CFQ16H	127	$-813
174	1CFQ22H	24	$946
175	1CFQ22S/B-COMPCT	8	$505
176	1CFQ22S/1B-COMPCT	6	$394
177	1CFQ26H	708	$2,866
178	1CFQ26S	8	$401
179	1CFQ28H	6	$-263
180	1CFQ28S	9	$68
181	1CFQ28S/.	2	$31
182	1CFQ28S/1B-COMPCT	37	$2,431
183	1CFT26H	13	$688
184	1CF13H	380	$671
185	1CF18H	10	$436
186	1CF5H	238	$-23
187	1CF9H	509	$1,881
188	1FO17/1B2-17T8	1	$18
189	1FO17/1B2-17T8/1R2-D0	2	$-446
190	1FO17/1B2-17T8/1R4-D0	2	$-15
191	1FO17/1B2-17T8/2DLAMP6	10	$460
192	1FO25/.25B3-EL	23	$80
193	1FO25/.3B3-EL	16	$59
194	1FO25/.33B3-EL	1	$23
195	1FO25/.5B3-EL	143	$218
196	1FO25/.5B3-EL/1R3-D1	6	$235
197	1FO25/1B3-EL	665	$367
198	1FO25/1B3-EL/1R3-D0	4	$-40
199	1FO25/1B3-T8	64	$550

SECTOR=COM STUDY=LIGHTING
(continued)

OBS	NEW_DESC	NEW_QTY	CUST_CST
200	1FO32/1B4-HY/1DLAMP2	2	$159
201	1FO32/1B4-ST/1DLAMP	17	$1,179
202	1FO32/1B4T8-2L	188	$159
203	1FO32/1B4T8-2L/1DLA	280	$1,023
204	1FO32/1B4T8-2L/1DLAMP	15	$576
205	1FO32/1B4T8-2L/1DLAMP2	336	$1,039
206	1FO32/1B4T8-2L/1R4-	187	$23,164
207	1FO32/1B4T8-2L/1R4-D0	14	$68
208	1FO32/1B4T8-2L/1R6-D1	10	$570
209	1FO32/1B4T8-2L/3DLAMP	1	$55
210	1FO40/.5B5-EL	154	$225
211	1FO40/1B5-EL	27	$32
212	1FO96/.5B8-T8	29	$154
213	1FO96/1B8-T8	41	$98
214	1F72/.5B6-EL	190	$10,450
215	1F72/1B6-EL	27	$216
216	1HP100	12	$-252
217	1HP150	4	$121
218	1HP200	5	$-155
219	1HP35	1	$-124
220	1HP360S	41	$5,186
221	1HP50	10	$96
222	1HP70	21	$-833
223	1MH100	61	$5,830
224	1MH150	80	$3,109
225	1MH400	45	$-3,228
226	1MH400/B8-STHO	26	$1,207
227	1MH400/1DLAMP	3	$-196
228	1MV160SB	34	$-34,139
229	1MV250	29	$-3,466
230	1XCF9K	88	$527
231	1XFLEX	8	$-1,502
232	1XLED1	154	$-1,114
233	1XSF20	8	$149
234	13W CF lamp	10,049	$777
235	13W CFL Reflector R-30 Fixture	3,490	$7,356
236	16CFQ26H	8	$9,214
237	17T8 Bal (2ft)	8,834	$1,523
238	17T8 Lamp (2ft)	18,405	$532
239	18W CF lamp	982	$524
240	2CFQ13H	802	$315
241	2CFQ13H/2B-COMPCT	9	$102
242	2CFQ22H	2	$177
243	2CF13H	267	$547
244	2CF7H	213	$-1,803
245	2CF9H	227	$1,268
246	2FO17/1B2-17T8	6	$485
247	2FO17/1B2-17T8/1R4-D2	1	$73
248	2FO17/1B2-17T8/1R4-D3	118	$23,560
249	2FO25/.5B3-EL	16	$237
250	2FO25/1B3-EL	1,144	$407

SECTOR=COM STUDY=LIGHTING
(continued)

OBS	NEW_DESC	NEW_QTY	CUST_CST
251	2FO25/1B3-EL/1DLAMP3	36	$963
252	2FO25/1B3-EL/1DLAMP8	3	$292
253	2FO25/1B3-EL/2R3-D0	40	$1,238
254	2FO25/1B3-T8	36	$511
255	2FO32/.5B4T8-4L	400	$6,791
256	2FO32/.5B4T8-4L/1DLAMP8	20	$907
257	2FO32/.5B4T8-4L/1R8-D0	15	$1,038
258	2FO32/1B4-HY	44	$1,851
259	2FO32/1B4T8-2L	5,606	$2,589
260	2FO32/1B4T8-2L/1DLA	554	$1,994
261	2FO32/1B4T8-2L/1DLAMP	239	$1,491
262	2FO32/1B4T8-2L/1DLAMP2	6	$166
263	2FO32/1B4T8-2L/1DLAMP8	809	$1,962
264	2FO32/1B4T8-2L/1R4-	27	$4,347
265	2FO32/1B4T8-2L/1R4-D0	28	$812
266	2FO32/1B4T8-2L/1R4-D1	1	$145
267	2FO32/1B4T8-2L/1R4-D2	12	$225
268	2FO32/1B4T8-2L/1R8-	271	$13,050
269	2FO32/1B4T8-2L/1R8-D0	744	$21,399
270	2FO32/1B4T8-2L/1R8-D1	71	$802
271	2FO32/1B4T8-2L/1R8-D2	80	$4,454
272	2FO32/1B4T8-2L/2DLA	7	$180
273	2FO32/1B4T8-2L/2DLAMP	31	$294
274	2FO32/1B4T8-2L/2DLAMP2	28	$448
275	2FO32/1B4T8-2L/2DLAMP8	53	$1,019
276	2FO32/1B4T8-2L/2R4-D0	14	$987
277	2FO32/1B4T8-2L/2R4-D1	41	$482
278	2FO32/1B4T8-2L/3DLA	9	$220
279	2FO32/1B4T8-2L/3DLAMP8	442	$2,996
280	2FO32/1B4T8-4L/1DLAMP8	387	$33,407
281	2FO72/1B6-EL	6	$614
282	2FO96/1B8-T8	144	$756
283	2FO96/1B8-T8/2DLAMP8	91	$1,702
284	2FO96H/1B4T8-2L/2R4-D0	102	$7,193
285	2F72/1B6-EL	8	$143
286	2F96H/1B8-ELHO	49	$2,646
287	2F96HE/1B8-ELHO	542	$18,970
288	2I125IR	13	$79
289	2UO31/1B2-31T8	8	$476
290	2XCF7K	70	$642
291	2XCF9K	44	$1,363
292	2ZCF125	2	$-19,573
293	20W CF lamp	9,591	$2,253
294	22W CF lamp	10,336	$1,637
295	26W CF lamp	314	$510
296	27W CF lamp	339	$310
297	27W CFL Floodlight Fixture	781	$267
298	3CFLE40H/1B-COMPCT	922	$26,251
299	3CFQ13H	36	$577
300	3CF13H	10	$-262
301	3CF13H/B8-ST	21	$2,617

SECTOR=COM STUDY=LIGHTING
(continued)

OBS	NEW_DESC	NEW_QTY	CUST_CST
302	3FO17/1B2-17T8	199	$4,794
303	3FO25/1B3-EL	62	$1,700
304	3FO25/1B3-EL/1R3-D1	46	$2,894
305	3FO32/1B4T8-3L/3R4-DO	25	$1,619
306	30W CF lamp	6,868	$1,517
307	30W CFL Ceiling Fixture	2,522	$1,929
308	31T8 U-Bal (2ft)	2,150	$1,156
309	31T8 U-Lamp (2ft)	3,852	$1,053
310	32 Watt lamp	161,794	$421
311	32CFQ26H	4	$-6,591
312	34 Watt lamp	0	$0
313	4CFLE40H	70	$11,776
314	4CF13H	24	$228
315	4FO25/1B3-EL	73	$432
316	4FO32/1B4-HY/1R8-D2	30	$2,802
317	4FO32/1B4T8-2L	4	$409
318	4FO32/1B4T8-4L	11,267	$3,403
319	4FO32/1B4T8-4L/1DLA	66	$2,516
320	4FO32/1B4T8-4L/1DLAMP8	243	$1,215
321	4FO32/1B4T8-4L/1R4-DO	506	$5,878
322	4FO32/1B4T8-4L/1R4-D2	129	$527
323	4FO32/1B4T8-4L/1R8-	9	$729
324	4FO32/1B4T8-4L/1R8-DO	1,052	$2,986
325	4FO32/1B4T8-4L/1R8-D1	84	$1,902
326	4FO32/1B4T8-4L/1R8-D2	187	$4,346
327	4FO32/1B4T8-4L/2DLA	1,474	$5,725
328	4FO32/1B4T8-4L/2DLAMP8	1,958	$6,241
329	4FO32/1B4T8-4L/2R4-	16	$2,199
330	4FO32/1B4T8-4L/2R4-DO	207	$5,708
331	4FO32/1B4T8-4L/2R4-D2	235	$1,935
332	4FO32/1B4T8-4L/4R4-DO	74	$9,105
333	4FO32/2B4T8-4L/1DLA	18	$1,087
334	4F4T1	4	$-17,334
335	4ZCF250	8	$-3,310
336	40T12 U-Lamp (2ft)	104	$973
337	6CFQ26H	3	$1,095
338	6FO32/2B4T8-3L/1DLAMP8	32	$4,460
339	6FO32/2B4T8-3L/2R4-D1	30	$1,376
340	7W CF lamp	37	$120
341	8CFQ26H	4	$3,277
342	8FO32/2B4-EL	12	$332
343	8FO32/2B4T8-4L	150	$884
344	9W CF lamp	122	$317

SECTOR=COM STUDY=HVAC

OBS	SIC3	COUNT
1	481	11
2	495	1
3	507	1
4	518	1
5	519	3
6	531	2
7	533	1
8	541	9
9	551	7
10	581	2
11	602	8
12	631	2
13	641	1
14	651	9
15	653	13
16	654	1
17	655	5
18	673	1
19	701	18
20	726	1
21	737	1
22	738	1
23	792	1
24	801	5
25	802	1
26	805	1
27	806	17
28	809	1
29	821	5
30	822	9
31	832	2
32	835	1
33	839	1
34	864	15
35	873	7
36	919	5
37	922	9
38	943	1
39	962	1
40	963	1

SECTOR=COM STUDY=LIGHTING

OBS	SIC3	COUNT
41	XXX	1
42	004	5
43	072	24
44	074	11
45	275	6
46	411	13

SECTOR=COM STUDY=LIGHTING
(continued)

OBS	SIC3	COUNT
47	422	4
48	431	5
49	472	1
50	481	13
51	483	4
52	493	3
53	495	1
54	503	5
55	504	19
56	506	9
57	507	21
58	508	9
59	513	1
60	518	10
61	519	24
62	520	6
63	523	10
64	525	5
65	531	199
66	533	35
67	539	49
68	541	352
69	546	4
70	551	13
71	552	1
72	553	8
73	554	190
74	555	7
75	561	26
76	562	10
77	565	52
78	566	30
79	571	36
80	573	23
81	581	797
82	591	29
83	593	4
84	594	85
85	596	1
86	599	120
87	600	76
88	602	128
89	603	91
90	614	9
91	616	2
92	621	1
93	637	1
94	641	78
95	651	345
96	653	370
97	654	11

SECTOR=COM STUDY=LIGHTING
(continued)

OBS	SIC3	COUNT
98	655	80
99	672	1
100	679	8
101	701	349
102	702	18
103	703	2
104	721	3
105	723	50
106	724	6
107	725	3
108	726	16
109	729	3
110	733	22
111	734	1
112	735	4
113	737	40
114	738	51
115	752	5
116	753	12
117	754	5
118	781	5
119	784	259
120	793	1
121	794	1
122	799	117
123	801	89
124	802	10
125	804	18
126	805	114
127	806	173
128	807	30
129	808	1
130	809	7
131	811	10
132	821	3338
133	822	143
134	823	14
135	824	2
136	829	8
137	832	13
138	835	27
139	836	122
140	839	14
141	841	23
142	861	11
143	863	13
144	864	32
145	866	120
146	871	51
147	873	116
148	874	6

SECTOR=COM STUDY=LIGHTING
(continued)

OBS	SIC3	COUNT
149	912	1
150	919	265
151	921	22
152	922	14
153	943	24
154	944	6
155	961	3
156	962	11
157	971	49
158	999	5

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

Lighting Load Impacts:

$$\text{Demand} = \frac{\text{Total } ex\ ante \text{ kW}}{\text{No. of Units}} = \frac{20{,}861}{63{,}399} = 0.33 \text{ kW}$$

$$\text{Energy} = \frac{\text{Total } ex\ ante \text{ kWh}}{\text{No. of Units}} = \frac{83{,}748{,}912}{231{,}798{,}543} = 0.36 \text{ kWh}$$

HVAC Load Impacts:

$$\text{Demand} = \frac{\text{Total } ex\ ante \text{ kW}}{\text{No. of Units}} = \frac{1{,}918}{13{,}311{,}263} = 0.0014 \text{ kW}$$

$$\text{Energy} = \frac{\text{Total } ex\ ante \text{ kWh}}{\text{No. of Units}} = \frac{19{,}305{,}070}{13{,}311{,}263} = 0.36 \text{ kWh}$$

SAN DIEGO GAS & ELECTRIC

M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY95 SECOND EARNINGS CLAIM FOR COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM

FIRST YEAR LOAD IMPACT EVALUATION, FEBRUARY 1997, STUDY ID NO. 959

Designated Unit of Measurement: LOAD IMPACTS PER AFFECTED SQUARE FOOT OF CONDITIONED SPACE.

End Use: HVAC (MILITARY)

				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 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:	Pre-install kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pre-install kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	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
	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:	Impact Yr kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Impact Yr kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	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
	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. i. Load Impacts - kW	1.100	1.100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	A. ii. Load Impacts - kWh	6,116	6,116	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B. i. Load Impacts/designated unit - kW	0.000	0.000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B. ii. Load Impacts/designated unit - kWh	0.082	0.082	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	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	1.000	1.163	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	D.A. ii. Load Impacts - kWh, realization rate	1.027	1.141	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	1.000	0.000	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	1.027	0.000	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	2									
	B. Number of measures installed by all program participants in the 12 months of the program year	2									
	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	971	100								

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M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY95 SECOND EARNINGS CLAIM FOR COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM

FIRST YEAR LOAD IMPACT EVALUATION, FEBRUARY 1997, STUDY ID NO. 959

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. 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 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:	Pre-install kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pre-install kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	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
	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:	Impact Yr kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Impact Yr kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	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
	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. i. Load Impacts - kW	427.171	427.171	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	A. ii. Load Impacts - kWh	2,775,738	2,775,738	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B. i. Load Impacts/designated unit - kW	0.213	0.213	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B. ii. Load Impacts/designated unit - kWh	0.363	0.363	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	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	0.588	0.684	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	D.A. ii. Load Impacts - kWh, realization rate	0.911	1.013	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	0.588	0.684	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	1.006	1.117	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	326,184									
	B. Number of measures installed by all program participants in the 12 months of the program year	495,922									
	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	971	99.6								
		919	0.3								
		458	<0.1								

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

Lighting Load Impacts:

$$\text{Demand} = \frac{\text{Total } ex\ ante \text{ kW}}{\text{No.of Units}} = \frac{10{,}168}{28{,}067} = 0.36 \text{ kW}$$

$$\text{Energy} = \frac{\text{Total } ex\ ante \text{ kWh}}{\text{No.of Units}} = \frac{42{,}850{,}428}{118{,}281{,}608} = 0.36 \text{ kWh}$$

Hvac Load Impacts:

$$\text{Demand} = \frac{\text{Total } ex\ ante \text{ kW}}{\text{No.of Units}} = \frac{1}{74{,}462} = 0.00001 \text{ kW}$$

$$\text{Energy} = \frac{\text{Total } ex\ ante \text{ kWh}}{\text{No.of Units}} = \frac{37{,}420}{74{,}462} = 0.50 \text{ kWh}$$

Appendix G

Appendix G

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:** 1995 Commercial Energy Efficiency Incentives Program: First Year Load Impact Evaluation, March 1997, MPAP-95-P50-959-R707, Study ID No. 959.

2. **Program, Program Year, and Program Description:** San Diego Gas & Electric offers the PY95 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.

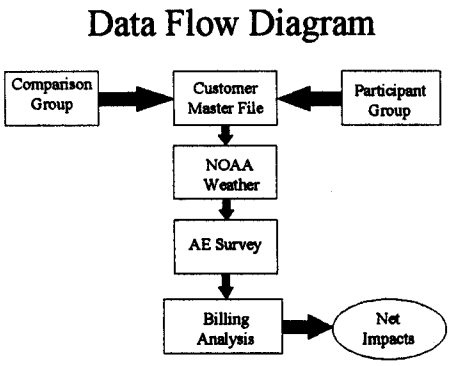
5. **Participant and Comparison Group Definition:** For the load impact analysis of the lighting and HVAC end uses, a participant was defined as a customer or a group of customers with a common contract for DSM measures who completed installation by December 31, 1995. A nonparticipant was defined as a customer who did not participate in any of SDG&E's PY95 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	978	394	99	392
No. of Measures Installed	613,106	NA	452	NA
Avg No. of Billing Months	27.9	28.0	27.0	29.0

B. Database Management

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



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. Information on other changes for all assigned customers in the participant and nonparticipant groups were obtained from a survey conducted on the account executives

   f. 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	1159	450	116	450
Billing Data Available	1110	439	107	440
Sufficient Pre/Post Data	1012	394	99	392
Customers involved only in the Retrofit Program	996	NA	99	NA
Customers with no overlapping contracts	978	NA	99	NA

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. From the account executives Survey, only the date of change was used in the analysis.

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. 6) and in Appendix C.

2. **Survey Information:** The relevant survey instruments are in Appendices B and C. 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

Savings greater than 1%	Parameter	No sqft data	Have sqft data	Grand Total
Commercial Participants				
No	Total Estimated Impact (kWh per month)	-421,067	-125,395	-546,461
	Variance of Estimate	24,446,046,140	24,066,125,661	48,512,171,801
	Total Database *Ex Ante* Estimate (kWh per month)	63,896	41,839	105,735
	Average Annual Hours	7,218	7,337	7,261
	Total Lighted Square Footage	0	2,887,994	2,887,994
	Sample Size	107	61	168
Yes	Total Estimated Impact (kWh per month)	-211,863	-2,721,973	-2,933,836
	Variance of Estimate	6,424,891,633	84,778,151,013	91,203,042,646
	Total Database *Ex Ante* Estimate (kWh per month)	597,172	2,415,086	3,012,257
	Average Annual Hours	7,635	5,261	5,901
	Total Lighted Square Footage	0	17,560,361	17,560,361
	Sample Size	178	482	660
	Load Impact (kWh per square foot, per 1,000 hours)		**-.3536**	
	Realization Rate Based On Sample *Ex Ante Estimates*	35%	113%	97%
Commercial Nonparticipants				
	Total Estimated Impact (kWh per month)		-132,027	
	Variance of Estimate		703,619	
	Average Annual Hours		5,088	
	Total Lighted Square Footage		8,031,740	
	Sample Size		311	
	Load Impact (kWh per square foot, per 1,000 hours)		**-.0388**	
Commercial Net-to-Gross			**89.0%**	

Space Cooling Energy Load Impacts

Savings greater than 1%	Item	No sqft data	Have sqft Data	Grand Total
Commercial Participants				
NO	Total Estimated Impact (kWh per month)	23,115	78,920	102,036
	Variance of Estimate	3,907,022,689	27,520,617,705	31,427,640,394
	Total Database *Ex ante* Estimate (kWh per month)	105,777	7,412	113,189
	Conditioned Square Footage	0	1,626,365	1,626,365
	Sample Size	10	13	23
YES	Total Estimated Impact (kWh per month)	-61,111	-233,870	-294,981
	Variance of Estimate	1,654,197,535	1,391,917,791	3,046,115,326
	Total Database *Ex ante* Estimate (kWh per month)	298,908	255,607	554,516
	Conditioned Square Footage	0	1,813,584	1,813,584
	Sample Size	20	37	57
	Load Impact (annual kWh per square foot)		**-1.55**	
	Realization rate based on sample *ex ante* estimates	20%	91%	53%
Commercial Nonparticipants				
	Total Estimated Impact (kWh per month)		-22,094	
	Variance of Estimate		5,107,245,950	
	Conditioned Square Footage		7,355,073	
	Sample Size		287	
	Load Impact (annual kWh per square foot)		-0.036	
	Commercial Net-to-Gross		**97.6%**	

D. Data Screening and Analysis

1. **Treatment for Outliers:** Outliers were determined using the RMSE criterion and the 1% Savings criterion. See p. 17.

   Customers with missing square footage and/or hours of operation were discarded in the calculation of the final load impacts but were subjected to the regression analysis. Customers with missing billing information were deleted from the analysis if the missing data caused the participant/nonparticipant to fail the billing data requirement.

2. A trend variable was included to account for any changes that occurred outside the DSM activity but could potentially affect the load impact estimate. See the discussion on the Non-Weather/Non-DSM Portion of the Regression Equation on p. 1.

3. See above item B.3. on Data Attrition.

4. **Regression Statistics:** See item C.3.

5. **Specification:**

   a. Individual regressions were estimated for each customer in the participant and nonparticipant groups. This accounts for customer heterogeneity.
   b. Weather and trends were accounted for in each customer regression analysis. See the General Model Section on pp. 12-13.
   c. No explicit accounting for self-selection bias was used in the model although SDG&E completed an alternative net-to-gross study that accounts for self-selection.
   d. SDG&E does not believe that any regressors of any consequence have been omitted from the analysis.
   e. This is discussed on p. 5 for the lighting end use and on p. 12 for the space cooling end use.

6. **Errors in Measuring Variables:** This was not addressed.

7. **Autocorrelation:** This was not accounted for in the model specification. It is SDG&E's opinion that when autocorrelation is not corrected, the analysis does not produce a biased estimate but may cause the estimator to be inefficient.

8. **Heteroskedacity:** Since ordinary least squares regression analysis when applied at the customer level, the variance of the regression disturbance terms can vary at the customer level, and the estimator will still be efficient.

9. **Collinearity:** Not significant.

10. **Influential Data Points:** Influential data points were determined based on the RMSE criterion and the 1% Savings criterion described on p. 6.

11. **Missing Data:** Sample points (participants and nonparticipants) that did not meet the billing data requirements were eliminated from the analysis. Although some sample points did not have square footage or hours of operation data, they remained part of the regression analysis. Their savings estimates, however, were not used in the calculation of the DUOM.

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. See p. 8.

M&E PROTOCOLS TABLE 7
DATA QUALITY AND PROCESSING DOCUMENTATION
For 1995 Commercial Energy Efficiency Incentives Program
Military Sector
First Year Load Impact Evaluation
February 1997
Study ID No. 959

A. OVERVIEW INFORMATION

1. **Study Title and Study ID:** 1995 Commercial Energy Efficiency Incentives Program: First Year Load Impact Evaluation, Process and Motor Measures, February 1997, Study ID No. 962.

2. **Program, Program Year(s), and Program Description (design):** 1995 Commercial Energy Efficiency Incentives Program for the 1995 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 and HVAC measures..

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

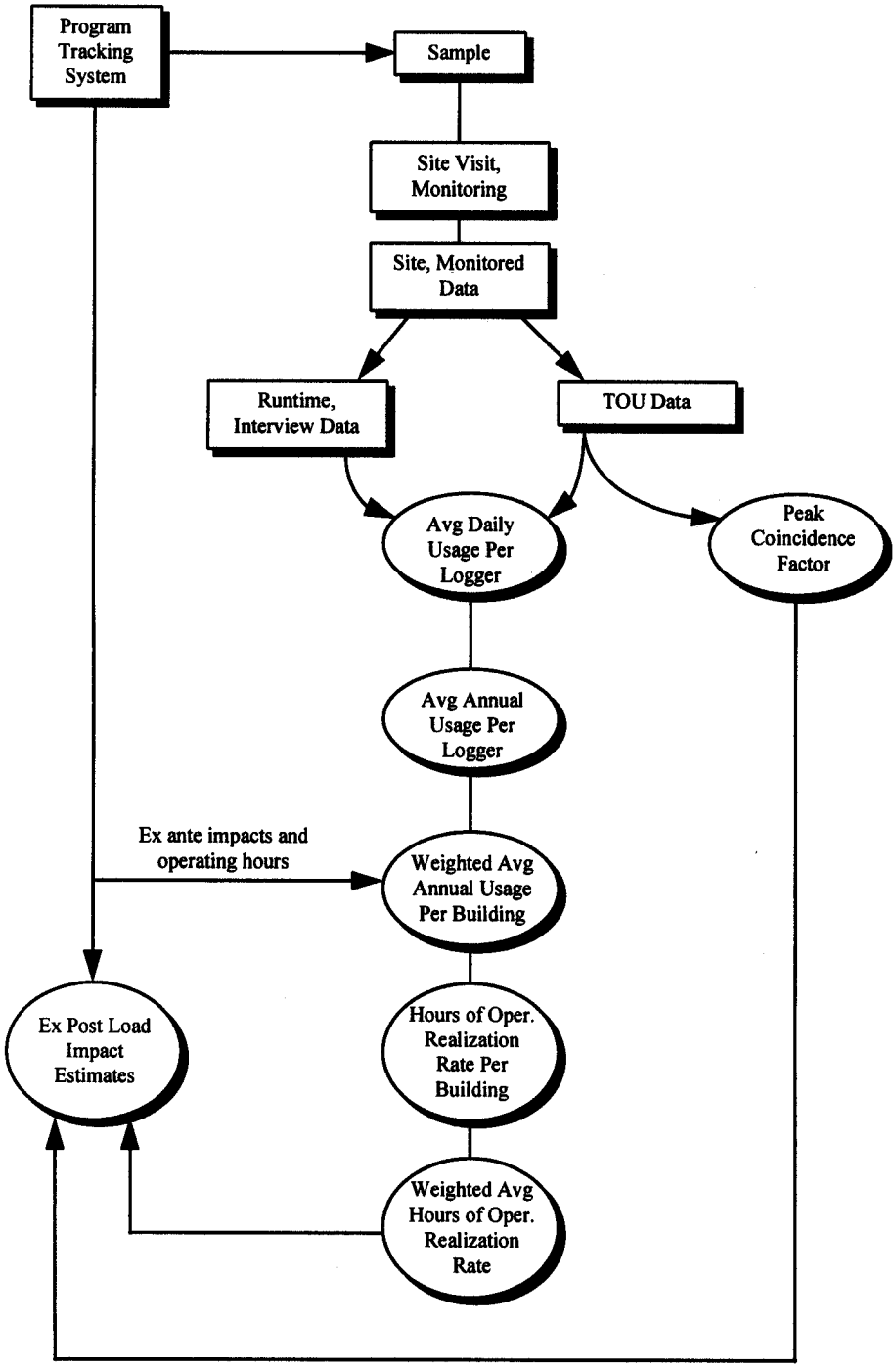
5. **Participant and comparison group definition:** For the load impact analysis, the participants in the 1995 Commercial Energy Efficiency Incentives Program in the military sectorare defined as having at least one of the aforementioned measures installed. A comparison group was not required for this evaluation.

6. **Analysis sample size:**

Electric Participant Sample for 1995 Commercial Energy Efficiency Incentives Program Military Sector			Gas Participant Sample for 1995 Commercial Energy Efficiency Incentives Program Military Sector		
Measure Type	No. of Participants	No. of Measures	Measure Type	No. of Participants	No. of Measures
Lighting	14	326,184	HVAC	0	0
HVAC	1	2		0	0
Total	15	326,186	Total	0	0

B. DATABASE MANAGEMENT

1. Flow Charts:



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**

      No attrition.

   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:** Sampling of the interior lighting measure participants was taken to assure 70% of the total program energy and demand levels were attained per the M&E Protocols. Census of the HVAC measure participants was conducted.

2. **Survey information:** On-site inspections were conducted that 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.