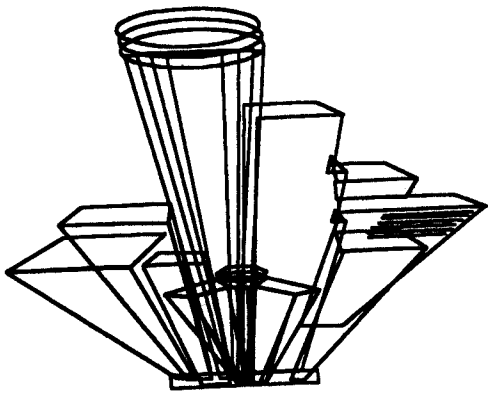
San Diego Gas & Electric
Marketing Programs & Planning
8306 Century Park Court
San Diego, California 92123

1994 Commercial Energy Efficiency Incentives Program

First Year Load Impact Evaluation and Retention Studies

February 1996



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Marketing Programs & Planning

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Executive Summary

This report was conducted to determine the first year load impacts for the commercial customers only. Commercial customers are a subset of all the nonresidential customers who participated in SDG&E's 1994 Commercial/Industrial/Agricultural (C/I/A) Energy Efficiency Incentives Programs. The C/I/A Energy Efficiency Incentives Programs help customers reduce energy costs and increase energy efficiency at their facilities. There are 6 major end uses covered by this report: (1) lighting, (2) HVAC, (3) lighting/HVAC combinations, (4) gas cooking, (5) combinations of measures other than lighting/HVAC , and (6) miscellaneous measures. The total number of commercial participants are:

Commercial Participants	No. of Participants
Lighting Only	690
HVAC Only	150
Combination Lighting/HVAC	41
Gas Cooking	4
Miscellaneous	79
Combinations Other Than Lighting/HVAC	10
Total	**975**

SDG&E obtained two waivers to the M&E Protocols (Appendix A):

1) a waiver to Table C-4 to treat gas cooking as a miscellaneous end use;

2) a waiver to evaluate all military bases under M&E Table C-5. 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 this study.

Load Impact Regression Models were used to determine the load impacts for lighting and HVAC for non-military commercial participants. The results are as follows:

End Use	Realization Rate	Net-to-Gross Ratio
Lighting	0.964	0.886
HVAC	0.918	1.087

A verification study was conducted by Xenergy, Inc. for measures installed in the military bases in SDG&E's service territory. There were a total of 202 buildings that participated in the program of which a sample

of 54 were surveyed. These sites installed only lighting measures. The overall realization rate for these military sites is 94.9%.

A first year measure retention study was done for the miscellaneous measures. SDG&E contracted with Xenergy to conduct this study. The study results show an overall retention rate of 98.2% for the first year.

Organization of Report

The report is organized into several sections.

Overview: This section presents the program description, a discussion of the participant database, nonparticipant group, and data collection.

Lighting & HVAC: This section discusses the regression models and results obtained for the first year load impact study for lighting and HVAC.

Military Bases: This section contains the first year load impact study conducted by Xenergy on the military bases.

Miscellaneous Measures: This section contains the first year retention study conducted by Xenergy, Inc. on miscellaneous measures.

Appendices: This section contains all the appendices referenced throughout the report.

Reporting Requirements: This section contains Tables 6 and 7 for the various end uses.

OVERVIEW

Overview

Program Description

San Diego Gas & Electric offers the 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 marketing 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.

C/I Incentives. This program typically targets the large customer where SDG&E's account executives representatives are involved in assisting customers with major retrofit applications. This program offers customers incentives 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 custom basis, providing the project meets the program cost-effectiveness tests.

Power to Save. This marketing strategy offers customers incentives 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.

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, and (3) energy efficient motors.

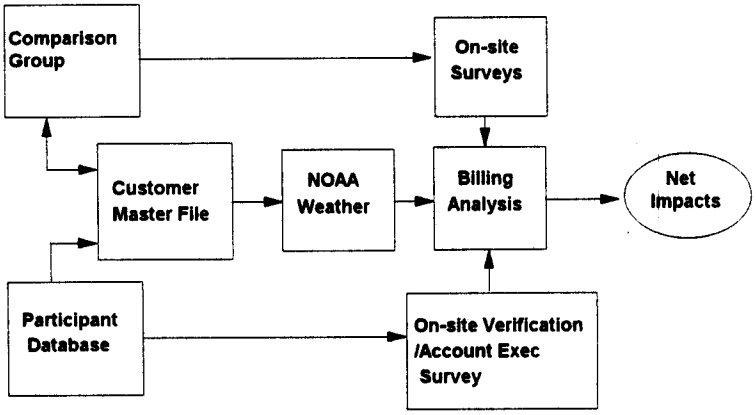
Sampling & Data Collection for the Lighting and HVAC End Uses

Data Collection

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

- Customer name, address, and installation date from the program tracking database;
- Comparison group 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, and occupancy from on-site audits for the comparison group;
- Information on other changes for all assigned customers in the Participant Group were obtained from a survey conducted on the account executives
- On site verification of installed measures for the Participant Group conducted by Xenergy, Inc.
- Hourly weather data for three climate zones from NOAA files; and
- Retention information on "miscellaneous measures."

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



Participant Database

A total of 833 Commercial customers (excluding the military bases) was identified in the 1994 Commercial/Industrial database for the lighting and HVAC load impact studies. An attempt was made to include all participants in the analysis.

Participants are broken down by end use as follows:

Lighting Only	683
HVAC Only	150
Total	**833**

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 1994. 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, covering the study period. A copy of the survey instrument is in Appendix B

A total of 793 surveys were sent out to 27 Account Executives with a cover letter explaining the survey. A total of 416 surveys or 52% indicated that there was "no change at all" to the company or how the company does business. There were 37 (5%) non responses. Forty-three percent of the responses reported 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). This information was incorporated in the analyses for lighting and HVAC.

Participant On Site Verification Study

In addition to the Account Executive Survey, a group of 141 lighting and HVAC participants was selected for on site verification by SDG&E. The objective of the on site survey was to verify the retention of lighting and HVAC measures. The selection criterion was based on an initial estimate of the realization rate[1] for the energy savings of the participants. The survey covered 99,000 measures. The verification study determined that there was an overall retention rate of 96% for all measures. The following table lists the retention rates for each end use.

End Use	Retention Rate
Lighting	0.944
HVAC	0.998
Overall	0.957

SDG&E contracted with Xenergy, Inc. to do the verification study. A copy of the verification study detailing the findings is in Appendix C.

Nonparticipant Group

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 to not have participated in any of the 1994 DSM Nonresidential programs. For the purpose of selecting the nonparticipant sample, the participants were grouped by annual kWh and the 10 building types as 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 one 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.

[1] The initial estimate of the realization rate was obtained from a regression model with the weather variable and *ex ante* estimate of savings as regressors.

A summary of the participant and nonparticipant groups by building type and size is given below. Note that a small building's consumption is less than 70,000 kWh per year; a medium building's consumption is 70,000 to 400,000 kWh; and a large building's consumption is greater than 400,000 kWh per year.

	Small		Medium		Large	
Segment	Participant	Nonparticipant	Participant	Nonparticipant	Participant	Nonparticipant
College	9	364	6	85	11	36
Grocery	2	1225	20	775	11	229
Hospital	0	232	1	60	3	71
Lodging	6	478	8	350	23	135
Nursing Homes	0	57	1	49	0	33
Restaurant	3	4166	51	1845	9	172
School	3	686	9	461	3	146
Retail	51	9325	50	2094	56	333
Offices	123	26382	66	2872	54	655
Com'l Bldg	46	19919	50	1796	29	377
Total	**243**	**62834**	**262**	**10387**	**199**	**2187**

On Site Audits of Nonparticipants

Volt Viewtech conducted the on site surveys of the nonparticipant sample for SDG&E. Detailed on site audits were conducted on 451 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. A copy of the survey instrument and the building type breakdown of the sample is provided in Appendix D.

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. For each customer in the participant and comparison groups, consumption data and weather data covered the period beginning January 1993 through October 1995.

Discussion of M&E Issues

HVAC Demand Savings Estimate

Cooling peak factors were available from several sources. The cooling peak factor is defined as the ratio of cooling demand coincident with system peak to annual cooling energy consumption. The load research end use metering sample provided two estimates for peak factors. The peak factor for 1994 was 0.046%. The peak factor for 1995 was 0.092%. A third estimate was derived from SDG&E's 1994 Market Segment End-Use Report (September 1995). The peak factor based on this study was 0.069%. The *ex ante* peak factor is 0.013%. **This ex ante estimate was derived based on individual engineering analysis** done SDG&E has chosen to use the *ex ante* peak factor to derive an estimate of the demand estimate due to the wide disparity between the various peak factors and it is the most conservative value.

Combinations of Lighting/HVAC and Lighting or HVAC with Miscellaneous End Uses

SDG&E did not do a separate analysis for the lighting/ HVAC and lighting or HVAC with miscellaneous end use combinations given that the sample size was too small (40 for lighting/HVAC and 10 for lighting or HVAC with miscellaneous end use combinations). In lieu of an analysis, SDG&E is applying the results of the separate lighting and HVAC analyses to this group.

Tables 6 and 7 of the M&E Protocols Reporting Requirements

Table 6 and Table 7 for Miscellaneous Measures were not completed. These tables were intended to report first year load impacts and not retention study results. However, the section on the first year retention study for these miscellaneous measures adequately discusses the results and methodology.

LIGHTING & HVAC

Lighting and HVAC End Uses

The Regression Model

The General Model

The Individual Elements of the General Model

Regressions will be constructed for customers indexed by i, using monthly data (indexed by t). Equation 1 is the broadest form of the customer regression equation, with three right-hand side components X, W, and S, and the usual disturbance term ε_{it}. Special cases of this general regression model will be applied for participants and nonparticipants, and for the lighting and HVAC end uses.

Equation 1 (The General Structure of the Regression Equation)

$$kWh_{it} = X_{it} + W_{it} + S_{it} + \varepsilon_{it}$$

Monthly electricity consumption (in kWh, adjusted for the length of the billing cycle), is on the left-hand side of Equation 1. The right-hand side of the equation is more complicated. The regression element X will have the structure,

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

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

X_{it} contains the intercept for the regression (β_{0i}) and a trend term. In addition, if there is a change in the regression equation (apart from the DSM activity yet to be discussed), the change to the intercept ($\Delta\beta_{0i}$) can be included in the equation using the zero-one indicator variable d_{it}.

As shown in Equation 3, W_{it} is simply proportional to the cooling degreehour variable cdh_{it}, a variable that has in past studies proven effective in explaining the majority of seasonal variation in energy consumption in the commercial sector.

Equation 3 (The Weather Portion of the Regression Equation)

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

Equation 4 gives the key element of the equation—the DSM impact on the regression equation:

Equation 4 (The DSM Savings Portion of the Regression Equation)

$$S_{it} = \rho_{it}(s_{it})$$

Equation 4 is consistent with a variety of well-known regression specifications for DSM impacts. The exact structure of the variable s_{it} is the heart of this report, and as such will be treated thoroughly later, for both participants and nonparticipants. For now we will point out that s_{it} can play the role of an *ex ante* calculation for

energy savings, in which case s_{it} would take the form of an indicator variable scaled by the *ex ante* estimate of savings.

At this point we introduce the rho function ρ_{it}. In the case of space-cooling savings we let rho vary with cooling degreehours, as in Equation 5:

Equation 5 (The General Structure of the rho Function)

$$\rho_{it} = \rho_{i0t} + \rho_{i1}(cdh_{it})$$

The rho function can play the role of the realization rate (defined as estimated savings as a fraction of the *ex ante* calculation), although we will maintain a more flexible point of view.

If the realization rate is increasing over time, e.g., due to increases in the occupancy rate at a customer's site, we would have a true constant (ρ_{i0}^{A}) and a trend term:

Equation 6 (The Non-Weather Portion of the rho Function)

$$\rho_{i0t} = \rho_{i0}^{A} + \rho_{i0}^{B}(t)$$

This yields the final structure for the rho function:

Equation 7 (The Final Structure of the rho Function)

$$\rho_{it} = \rho_{i0}^{A} + \rho_{i0}^{B}(t) + \rho_{i1}(cdh_{it})$$

The Final Form of the General Model

Using Equation 2 through Equation 6 in Equation 1, we have the final regression equation that will be used throughout the report (regressors are given in curly brackets):

Equation 8 (The Final Regression Equation)

$$kWh_{it} = \beta_{0i} + \beta_{1i}\{t\} + \Delta\beta_{0i}\{d_{it}\} + \beta_{2i}\{cdh_{it}\} + \rho_{i0}^{A}\{s_{it}\} + \rho_{i0}^{B}\{(t)(s_{it})\} + \rho_{i1}\{(cdh_{it})(s_{it})\} + \varepsilon_{it}$$

Equation 8 is a well-defined regression equation in seven coefficients. In general, the equation allows for non-DSM changes in the intercept, a general trend, weather influences, and weather-related and trended realization rates. We now turn to special cases of this model.

Commercial Lighting End Use Model

The Participant Regression Model

The Regression Equation

At this point we will specify Equation 8 for lighting participants. In this context, there will be two exact specifications. First, cdh_{it} will be removed from the DSM portion of the model by imposing the constraint $\rho_{i1} = 0$, so that we now have the following regression equation for lighting participants:

Equation 9 (Lighting Participants--The Final Regression Equation)

$$kWh_{it} = \beta_{0i} + \beta_{1i}\{t\} + \Delta\beta_{0i}\{d_{it}\} + \beta_{2i}\{cdh_{it}\} + \rho_{i0}^{A}\{s_{it}\} + \rho_{i0}^{B}\{(t)(s_{it})\} + \varepsilon_{it}$$

Second, we must exactly specify the DSM savings function s_{it}.

The exact specification for s_{it} can best be understood by considering two important cases:

Case 1. The lighting participant experienced a single lighting retrofit.

Case 2. There has been more than one lighting retrofit at a site within the relevant time period.

In either case, the structure of the s_{it} variable begins with the *ex ante* estimate of energy savings, available from the program database. In Case 1, we have a single *ex ante* estimate S_i^{annual} (annual kWh), in which case the savings function (based on an equal distribution of annual hours over time),

Equation 10 (The Savings Function-Case 1)

$$s_{it} = \left(\frac{S_i^{annual}}{12}\right)\left(d_{it}^{lighting}\right) = \left(S_i\right)\left(d_{it}^{lighting}\right)$$

where $d_{it}^{lighting}$ is a standard zero-one indicator variable determined by the month of the lighting retrofit. In this setting the monthly savings figure S_i is simply a constant (at the customer level), so that we have the option of estimating savings directly based on the indicator variable.

However, in Case 2 the aggregate *ex ante* monthly savings estimate is simply the sum of the individual *ex ante* (indexed by j):

$$S_i = \sum_j S_{ij}$$

Consistent with this, we would have several expressions with the same structure as Equation 10:

Equation 11 (An Element of the Savings Function-Case 2)

$$s_{ijt} = \left(\frac{S_{ij}^{annual}}{12}\right)\left(d_{ijt}^{lighting}\right) = \left(S_{ij}\right)\left(d_{ijt}^{lighting}\right),$$

However, if we impose the assumption that the relevant regression coefficients are constant across j (this will amount to assuming a constant realization rate for each job at the customer level), we have the aggregate savings function,

Equation 12 (The Savings Function-Case 2)

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

Deriving Statistical Estimates of Customer Savings That are Comparable to *Ex Ante* Estimates

Ex ante savings estimates are certainly derived with a set of circumstances in mind (e.g., normal weather conditions, a given level of building occupancy, etc.). When there is no variation over time in the DSM savings portion of the model (when, for example, $\rho_{i0}^{B} = 0$ in the lighting model) this matter is inconsequential. However, when there is trending we must make an assumption concerning the point in time at which the *ex ante* estimate of savings applies. The statistical estimate for customer savings—based on the regression model—will have the form,

Equation 13 (The Statistical Estimate of Customer Savings)

$$\hat{S}_i = \left\{\rho_{i0}^{A} + \rho_{i0}^{B}\left(t^*\right)\right\} S_i$$

where, in this study, t^* was taken to be the latest month in the customer's sample (typically late 1995). We note from this, that in this setting, the rho function in Equation 7 (recalling the constraint $\rho_{i1} = 0$) is the realization rate at the customer level, since the realization rate has the structure, $\hat{S}_i / S_i$.

Accounting for Other Reported Changes

The last element of the regression is the simple indicator variable d_{it}. Most of the major lighting retrofit jobs are associated with one of the company's account executives. The account executives constitute a rich source of information. The account executives were given a survey concerning each of their retrofit jobs. The survey questions centered around non-DSM ("other") energy-consumption changes at the customer site in question. Nearly half of the surveys resulted in reports of other changes. As a result, the goal was to find some systematic means of enveloping the impact of these changes on the regression model, ending with a simple modification of the intercept term in $\Delta\beta_{0i}$ in Equation 8. The timing of the other change was actually estimated; the month during which the associated indicator variable d_{it} took on the value one (versus zero in prior months) was determined on a best-fit basis (along with the rest of the regression parameters). However, in Case 1 above, the variables d_{it} and s_{it} could be collinear if they were associated with the same point in time. As a result, the search activity for d_{it} (the process of minimizing the regression's residual sum-of-squares by searching across months) was limited to two months before and after the installation date.

Estimation Methods

All regression equations were estimated at the customer level using ordinary least-squares estimation methods. Based on general experience, data on retrofit completion dates used in constructing the indicator variable $d_{it}^{lighting}$ were "discounted" somewhat: three months of data prior to the recorded inspection date were excluded from the regression. This keeps the uncertainty associated with the completion date from seriously biasing the estimation results. Equation 9 was the exact regression equation that was estimated, with Equation 13 the final result.

Although the details of the data will be discussed later, customer-specific regressions most often included 36 months of consumption, weather, and miscellaneous data, with a minimum of 12 months of pre-installation data, and a minimum of 9 months of post-installation data.

Designated Units of Measurement

The M&E Protocols require that the estimation results be combined with square footage data, hours of operation data, and *ex ante* estimates of savings. Based on reported customer square footage data F_i, savings per square foot, per 1,000 hours of operation would simply be for an average annual hours of operation figure $\overline{H}$,

Equation 14 (Savings per Square Foot per 1,000 Hours of Operation)

$$\overline{w} = -\frac{12 \times \sum_i \hat{S}_i}{\sum_i F_i}\left(\frac{1{,}000}{\overline{H}}\right)$$

The annual energy impact per square foot is a similar expression:

Equation 15 (Annual Savings per Square Foot)

$$\overline{SSQFT} = -\frac{12 \times \sum_i \hat{S}_i}{\sum_i F_i}$$

Finally, the average impact over participants is,

Equation 16 (Annual Savings per Participant)

$$\bar{S} = -\frac{12 \times \sum_{i=1}^{n} \hat{S}_i}{n}$$

The M&E Protocols contain a requirement for the savings realization rate. At the gross-impact level, the realization rate for lighting participants can be calculated according to,

Equation 17 (The Realization Rate for Lighting Participants)

$$\rho = \frac{\sum_i \hat{S}_i}{\sum_i S_i}$$

The Nonparticipant Model

The Regression Equation

Several practical points govern our development of the nonparticipant model based on the general model in Equation 9:

1) In the case of nonparticipants, there are no known *ex ante* savings estimates, S_i.
2) There are no data on "other" changes. the changes associated with the indicator variable d_{it} in the participant model.
3) While the nonparticipant model must certainly deal with changes in energy consumption during the relevant time period, there is no reasonable way to model more than one discrete change, in addition to the trend already included in the model.

Consider the implication of these points with respect to Equation 9. Point 2) alone gives us,

Equation 18 (Modifying the Participant Model)

$$kWh_{it} = \beta_{0i} + \beta_{1i}\{t\} + \beta_{2i}\{cdh_{it}\} + \rho_{i0}^{A}\{s_{it}\} + \rho_{i0}^{B}\{(t)(s_{it})\} + \varepsilon_{it}$$

Point 3) limits us to Case 1 described in the participant model, so the structure of the "DSM savings" portion of the model is that of Equation 10, giving a new superscript to $d_{it}^{lighting}$:

$$s_{it} = (S_i)\left(d_{it}^{nonpart}\right)$$

This gives,

Equation 19 (Lighting--The Nonparticipant Model)

$$kWh_{it} = \beta_{0i} + \beta_{1i}\{t\} + \beta_{2i}\{cdh_{it}\} + \left[\rho_{i0}^{A}(S_i)\right]\left\{\left(d_{it}^{nonpart}\right)\right\} + \left[\rho_{i0}^{B}(S_i)\right]\left\{(t)\left(d_{it}^{nonpart}\right)\right\} + \varepsilon_{it}.$$

The square-bracketed expressions in Equation 19 are simply regression coefficients for nonparticipants which have taken on the scale of S_i. This is fortunate since according to Point 1), this scale is unknown. The corresponding "savings" estimate is simply,

Equation 20 (Estimated Savings for Nonparticipants)

$$\hat{S}_i = \rho_{i0}^{A}(S_i) + \rho_{i0}^{B}(S_i)(t^*) = \left\{\rho_{i0}^{A} + \rho_{i0}^{B}(t^*)\right\}(S_i)$$

which corresponds exactly to the participants savings given in Equation 13. In turn, we can construct the equivalent of Equation 14, Equation 15, and Equation 16 for nonparticipants, given data on hours of operation and square footage. While this expression *may* estimate savings from DSM measures among nonparticipants, it most likely represents a basis for correcting the gross impact estimate for any broad-based changes during the program year.

Estimation Methods

The nonparticipant model in Equation 19 was estimated using ordinary least-squares. Specifically, the structure of the indicator variable of some significant change in consumption, $d_{it}^{nonpart}$, (in terms of the point in time at which the variable took on the value one) was determined on a best fit basis, searching across the 12 months of the program year.

Net Impact and Net-to-Gross

Equation 14, Equation 15, and Equation 16 can be used to construct net impact as the difference between participants and nonparticipants:

Equation 21 (Net Impact—The Difference in Savings per Square Foot, per 1,000 Hours)

$$\Delta\overline{w} = \overline{w}_{part} - \overline{w}_{nonpart}$$

Equation 22 (Net Impact—The Difference in Savings per Square Foot)

$$\Delta\overline{w} = \overline{SSQFT}_{part} - \overline{SSQFT}_{nonpart}$$

Equation 23 (Net Impact—The Difference in Savings per Customer)

$$\Delta\overline{S} = \overline{S}_{part} - \overline{S}_{nonpart}$$

This leads directly to estimates of the net-to-gross ratio,

Equation 24 (Net-to-Gross Ratio Based on Savings per Square Foot, per 1,000 Hours)

$$\eta_w = \frac{\Delta\overline{w}}{\overline{w}_{part}} = 1 - \frac{\overline{w}_{nonpart}}{\overline{w}_{part}}$$

Equation 25 (Net-to-Gross Ratio Based on Savings per Square Foot)

$$\eta_{SSQFT} = \frac{\Delta\overline{SSQFT}}{\overline{SSQFT}_{part}} = 1 - \frac{\overline{SSQFT}_{nonpart}}{\overline{SSQFT}_{part}}$$

Equation 26 (Net-to-Gross Ratio Based on Savings per Customer)

$$\eta_S = \frac{\Delta\bar{S}}{\bar{S}_{part}} = 1 - \frac{\bar{S}_{nonpart}}{\bar{S}_{part}}$$

This completes the fundamentals of the lighting model. At this point, we begin a discussion of the HVAC model, followed by results for both lighting and HVAC.

Space Cooling (HVAC) End Use Model

Preliminary tests of the regression model in Equation 8 caused SDG&E to drop the trend-related terms from the cooling model. The inclusion of both the trended element and the cooling degreehour regressor cdh_{it} in the savings function given in Equation 7 caused the overall savings measurement effort to break down. The regression equation, for example, was assigning significant trends to a large number of data series that simply, by inspection, were not trending.

The estimation process proceeded with the trend terms suppressed. While there was little hope of estimating energy for participant data series that were trending upward, SDG&E believed that the same effect might hold true in the nonparticipant model, and that the net impact calculation might control indirectly for the trending effect. The forthcoming results section point to this, to some extent.

The Participant Regression Model

With the trend terms suppressed, the cooling model becomes a simplified version of Equation 8:

Equation 27 (The Final Cooling Regression)

$$kWh_{it} = \beta_{0i} + \Delta\beta_{0i}\{d_{it}\} + \beta_{2i}\{cdh_{it}\} + \rho_{i0}^{A}\{s_{it}\} + \rho_{i1}\{(cdh_{it})(s_{it})\} + \varepsilon_{it}$$

The first two regressors d_{it} and cdh_{it} were handled as in the lighting model. Customer weather-normalized savings (equivalent to Equation 13) becomes,

Equation 28 (The Statistical Estimate of Customer Savings)

$$\hat{S}_i = \left\{\rho_{i0}^{A} + \rho_{i1}\left(\overline{cdh_i}\right)\right\}S_i$$

for a long-term cooling degreehour value $\overline{cdh_i}$. As in the lighting case, the annual energy impact per square foot is,

Equation 29 (Cooling--Annual Savings per Square Foot)

$$\overline{SSQFT} = -\frac{12 \times \sum_i \hat{S}_i}{\sum_i F_i}$$

and the average impact over participants is,

Equation 30 (Cooling--Annual Savings per Participant)

$$\bar{S} = -\frac{12 \times \sum_{i=1}^{n} \hat{S}_i}{n}$$

Similar to the lighting case, at the gross-impact level, the realization rate for cooling participants can be calculated according to,

Equation 31 (The Realization Rate for Space Cooling Participants)

$$\rho = \frac{\sum_i \hat{S}_i}{\sum_i S_i}$$

This brings us to the nonparticipant model.

The Nonparticipant Regression Model

Following the same line of reasoning found in the lighting case (in Equation 18 and Equation 19), while suppressing the trend terms and maintaining cooling degreehours in the savings function, we get the nonparticipant regression model corresponding to Equation 19:

Equation 32 (Cooling--The Nonparticipant Model)

$$kWh_{it} = \beta_{0i} + \beta_{2i}\{cdh_{it}\} + \left[\rho_{i0}^{A}(S_i)\right]\left\{\left(d_{it}^{nonpart}\right)\right\} + \left[\rho_{i1}(S_i)\right]\left\{\left(cdh_{it}\right)\left(d_{it}^{nonpart}\right)\right\} + \varepsilon_{it}$$

Estimated "savings" are then,

Equation 33 (Cooling--Estimated "Savings" for Nonparticipants)

$$\hat{S}_i = \rho_{i0}^{A}(S_i) + \rho_{i1}(S_i)\left(\overline{cdh_i}\right) = \left\{\rho_{i0}^{A} + \rho_{i1}\left(\overline{cdh_i}\right)\right\}(S_i)$$

Net Impact and Net-to-Gross

Corresponding to the same equations in the lighting case (Equation 15 and Equation 16), average savings (per square foot and per customer) for either participants or nonparticipants are given by,

Equation 34 (Cooling--Annual Savings per Square Foot)

$$\overline{SSQFT} = -\frac{12 \times \sum_i \hat{S}_i}{\sum_i F_i}$$

Equation 35 (Cooling--Annual Savings per Participant)

$$\bar{S} = -\frac{12 \times \sum_{i=1}^{n} \hat{S}_i}{n}$$

In addition, two of the three formulas for lighting net-to-gross are available for cooling:

Equation 36 (Cooling--Net-to-Gross Ratio Based on Savings per Square Foot)

$$\eta_{SSQFT} = \frac{\Delta\overline{SSQFT}}{\overline{SSQFT}_{part}} = 1 - \frac{\overline{SSQFT}_{nonpart}}{\overline{SSQFT}_{part}}$$

Equation 37 (Cooling--Net-to-Gross Ratio Based on Savings per Customer)

$$\eta_S = \frac{\Delta\bar{S}}{\bar{S}_{part}} = 1 - \frac{\bar{S}_{nonpart}}{\bar{S}_{part}}$$

Results

SDG&E believes that the regression models contained in this report proved to be effective in supporting the majority of the *ex ante* estimates of energy savings. The results from the models are disaggregated by groups of electricity customers in a way that provides, SDG&E believes, the greatest amount of insight in terms of both the strengths and shortcomings of the model. This groups of customers are summarized as follows:

1. For lighting, customers were grouped into those with estimated monthly kWh exceeding 300,000 kWh (only 15 in number), and those below this mark.
2. For cooling, participants were grouped into those with a very low *ex ante* savings estimate (less than 400 kWh per month), those with a very high *ex ante* savings estimate (greater than 60,000 kWh per month), and a third group between these two marks.

It should be made clear that these groups were defined only after the regression results were examined, and that the lighting and cooling groupings are obviously based on a different criterion. However, SDG&E believes that these groupings are made in good faith, and in a way that shines the greatest light on the empirical evidence for energy savings. SDG&E has attempted to undertake an intelligent line of research, consistent with this position. It should also be noted that in the Results section which follows, enough information is contained so that the reader can construct the relevant results in the absence of the disaggregation of customers into groups.

Commercial Lighting Results

Table 1 gives overall lighting results for the commercial sector, disaggregated into the two groups already mentioned. The focus here will be on the 614 participants where estimated monthly kWh consumption is below the 300,000 kWh level. The 614 participants in this study group were actually a 93% majority in an original group of 658 participants installing lighting measures (among those who had also met the criterion of less than 300,000

estimated kWh monthly consumption). Of the 658, nine participants had insufficient post-retrofit billing data (9 months of data were required as a minimum, in line with the M&E Protocols), and 32 participants had insufficient pre-retrofit billing data (12 months of data were required as a minimum). One participant (with a negligible forecast for *ex ante* savings) was eliminated due to the fact that the associated square footage data was out of the realm of reason for the small *ex ante* savings estimate. Additionally, one lighting job associated with a major university were eliminated (for the same reasons that would be applied given a retrofit at a military installation or a large government site), as was one site whose billing data was impacted by sizable cogeneration facilities. As given in Table 1, 15 participants were included in the "> 300,000 kWh" category. This group of 15 excludes three customers who would have fallen into this group if not eliminated: one additional university-based case, one case with insufficient pre-retrofit data, and a third case where the billing series simply was not, by any means, applicable to regression analysis due to gross changes in the billing data over time. As a result, the 614 participants that SDG&E advances as the core of the participant study are made up of an original commercial group of 676, implying a fairly reasonable attrition rate of less than 10%. The data attrition is summarized in the M&E Reporting Requirements Table 7, section B, part 3(a).

As described earlier, the nonparticipant commercial group was drawn as a sample based on comparable consumption levels with respect to the participant group. They are 405 and 10 in number, for the two classifications. No nonparticipants were excluded from the sample.

Conditioned on the 300,000 kWh breakout, the lighting results are fairly strong. According to Table 1, 96.4% of gross kWh savings was verified within the group of 614. The standard error for this percentage is 9.3%, pointing to the general reliability of the estimate. The gross impact per designated unit of measurement (kWh per square foot, per 1,000 hours of operation) is a reasonable 0.44. The net-to-gross ratio is calculated using the three means described in the body of the report, with all three results being in the neighborhood of 90%. This is consistent with nonparticipant survey results (see Appendix E) which indicates that approximately 10% of nonparticipants installed some sort of efficient lighting measures during the relevant period.

Table 1--Commercial Lighting Results

	Estimated Monthly kWh (< 300,000)	Estimated Monthly kWh (> 300,000)
PARTICIPANT GROUP		
Total Estimated Impact (kWh per month)	(2,332,904)	(1,070,763)
Variance of Estimate	50,250,898,931	107,467,091,412
Total *Ex Ante* Estimate of Savings (kWh per month)	2,420,720	478,078
Total Lighting Square Footage	13,689,839	3,749,072
Count	614	15
Average Annual Hours	4,687	5,163
Realization Rate (Gross Impact)	96.4%	224.0%
Standard Error of Realization Rate	9.3%	68.6%
Impact per Square Foot per 1,000 Hours	0.44	0.66
Impact per Square Foot (Annual kWh)	2.04	3.43
Average Impact (Annual kWh)	45,594	856,611
NONPARTICIPANT GROUP		
Total Estimated Impact (kWh per month)	(161,354)	(718,571)
Variance of Estimate	9,059,305,917	22,898,265,067
Total *Ex Ante* Estimate of Savings (kWh per month)	na	na
Total Lighting Square Footage	10,190,740	1,631,869
Count	405	10
Annual Hours	3,935	6,158
Impact per Square Foot per 1,000 Hours	0.05	0.86
Impact per Square Foot (Annual kWh)	0.19	5.28
Average Impact (Annual kWh)	4,781	862,286
NET-TO-GROSS		
Impact per Square Foot per 1,000 Hours	88.9%	-29.2%
Impact per Square Foot (Annual kWh)	90.7%	-54.2%
Average Impact (Annual kWh)	89.5%	-0.7%

Commercial Space Cooling Results

Table 2 gives overall cooling results for the commercial sector, disaggregated into the three groups already mentioned. The focus here will be on the main group where *ex ante* estimates of monthly kWh consumption is between 400 and 60,000 kWh. The 76 participants in this study group were a 90% majority in an original group of 84 participants installing cooling measures (among those who had also met the criterion of between 400 and 60,000 kWh monthly consumption). Of the 84, six participants had insufficient post-retrofit or pre-retrofit billing data. Two very large customers who had relatively small *ex ante* estimates (but still greater than 400 monthly kWh) were eliminated from the study, even though the two cases did much to offset each other in terms of the results. With respect to those cases where estimated monthly kWh is less than 400, the 51 participants in Table 2 exclude one participant with insufficient post-retrofit data, and six participants for whom square footage data were missing.

Of the three customer groups in Table 2, two are sizable in terms of numbers of customers (76 and 51 customers). However, the 51 customers are associated with an aggregate *ex ante* monthly savings estimate (7,648 kWh) that is only 1% of that associated with the 76 "mid-range" customers (559,046 kWh). On the other hand, the four customers which constitute the "> 60,000" category are associated with an *ex ante* estimate (281,803 kWh) that is 50% of the main 559,046 kWh figure. The difficulty lies in getting reasonable econometric estimates in these large cases.

Conditioned on the Table 2 breakout, the cooling results are within reason. Recall that the cooling model was a non-trended model. This causes many of the cases with upward trending consumption data to have downward-biased estimates of gross savings (this was actually observed on a systematic basis when the regression results were studied). On the other hand, this bias can be offset during the net impact calculation, since the nonparticipant regression model was non-trended as well. Consistent with this, we see a lower gross impact realization rate in Table 2 (72.5%), and a net-to-gross ratio greater than one. It may very well be that the realization rate is a higher number, while, as we fully expect, the true net-to-gross figure is less than one.

Table 2--Commercial Cooling Results

	400 kWh < Ex Ante Estimate < 60,000 kWh	Ex Ante Estimate < 400 kWh	Ex Ante Estimate > 60,000 kWh
PARTICIPANT GROUP			
Total Estimated Impact (kWh per month)	(405,090)	12,505	290,349
Variance of Estimate	6,617,692,959	7,392,638,539	4,448,014,161
Total Ex Ante Estimate of Savings (kWh per month)	559,046	7,648	281,803
Total Square Footage	6,226,584	9,145,460	707,442
Count	76	51	4
Realization Rate (Gross Impact)	72.5%	-163.5%	-103.0%
Standard Error	14.6%	1124.2%	23.7%
Impact per Square Foot (Annual kWh)	0.78	(0.02)	(4.93)
Average Impact (Annual kWh)	63,962	(2,942)	(871,047)
NONPARTICIPANT GROUP			
Total Estimated Impact (kWh per month)	180,938		
Variance of Estimate	3,321,569,332		
Total Square Footage	10,454,356		
Count	391		
Impact per Square Foot (Annual kWh)	(0.21)	(0.21)	(0.21)
Average Impact (Annual kWh)	(5,553)	(5,553)	(5,553)
NET-TO-GROSS			
Impact per Square Foot (Annual kWh)	126.6%	-1165.8%	95.8%
Average Impact (Annual kWh)	108.7%	-88.7%	99.4%

MILITARY INSTALLATIONS
BY XENERGY

1994 COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM

MILITARY INSTALLATIONS

FIRST YEAR LOAD IMPACT EVALUATION

Prepared for

San Diego Gas & Electric
San Diego, California

Prepared by

XENERGY Inc.
San Diego, California

February 1996

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XENERGY

1 INTRODUCTION

As part of its efforts to evaluate the impacts of its demand-side management (DSM) programs San Diego Gas & Electric (SDG&E) endeavors to conduct *1994 Commercial Energy Efficiency Incentives Program First Year Load Impact Evaluation of Military Installations*. The majority of DSM measures installed in Miliatary Installations was lighting.

This study is tailored along the structure of a simplified engineering study with verified input parameters. The parameter verified for this study is the hours of operation. The hours of operation were selected for verification since it is the most volatile of parameters in the basic equation for estimating energy savings from lighting retrofit measures.

1.1 OVERVIEW

Nine lighting retrofit projects installed at Military Installations during 1994 comprised the facilites that were part of this study. Each of the nine projects was composed of multiple buildings. A sample of buildings from each site was selected and light loggers installed on a sample of fixtures within each building to estimate the hours of operation for the buildings monitored. Realization rates for the hours of operation, defined as the hours estimated through metering divided by the *ex ante* hours, were estimated for each building. The building level realization rates were weighted to the project level and the overall Military Installation level for 1994.

1.2 SUMMARY OF RESULTS

Table 1-1 provides a summary of the estimated hours of operation and realization rates for hours of operation.

Table 1-1
Estimated Realization Rates For Hours of Operation
1994 Military Installations

Base ID #	Estimated Annual Hours	*Ex Ante* Hours	Realization Rates
1	3,266	4,710	0.69
2	3,630	4,338	0.84
3	4,501	3,798	1.19
4	3,817	3,928	0.97
5	4,051	3,721	1.09
6	3,036	3,691	0.82
7	3,621	3,439	1.05
8	4,234	5,609	0.75
9	3,502	2,800	1.25
Overall Weighted Average			0.95

1.3 ORGANIZATION OF REPORT

The remainder of this report is orgranized as follows:

Section 2	Results and Findings
Section 3	Methodology

2 RESULTS

2.1.1 Overview

This section presents the results of the *1994 Commercial Energy Efficiency Incentives Program First Year Load Impact Evaluation of Military Installations*. Lighting retrofit projects at nine Military Installations (Bases) were included in the study. Light loggers were installed at a sample of buildings at each Base to gain insight on the hours of use of lighting fixtures. This parameter is the most likely to affect the actual energy use through a lighting retrofit project. As such, this parameter was selected for monitoring.

2.1.2 Measurement Findings

A sample of buildings that would best represent each Base was selected from the 1994 Commercial Energy Efficiency Incentives Program tracking database. Table 2-1 shows the number of buildings and the projected kWh savings associated with each Base. Through the sampling process buildings that accounted for a greater share of the energy savings achieved through the lighting retrofit were selected for monitoring. Thus, the 25 percent of the buildings monitored accounted for approximately two-thirds of the total energy savings.

Table 2-1
Description of Military Installations

Base ID #	No. Buildings Retrofit at the Base	Number of Buildings Monitored	Total kWh Savings at the Base	kWh Savings for Buildings Monitored
1	67	10	1,082,158	644,750
2	N/A*	6	1,228,386	772,810
3	52	12	1,105,064	688,394
4	20	3	78,123	50,701
5	9	3	37,760	26,293
6	5	2	44,775	24,532
7	31	10	2,147,453	1,475,596
8	14	5	794,942	515,956
9	4	3	266,394	251,339
Total	202	54	6,785,055	4,450,371

*Note: Tracking system data base was not complete for the Base #2. Tracking system records were based on the type of building, not on an individual building basis.

The data in Table 2-2 shows the *ex ante* hours of operation, hours of operation estimated through monitoring, and the realization rate for hours of operation for the Bases. The *ex ante* and monitored hours were estimated at the building level. They were weighted to the Base level. The weights were based on energy savings. The realization for Military Installations was 0.949. This realization rate is interpreted as: the hours of operation estimated through this study is 94.9 percent of the hours of operation from the program tracking system.

Table 2-2
***Ex Ante* and Monitored Hours of Operation**

Base ID #	Ex Ante Hours	Monitored Hours	Realization Rate
1	4,710	3,266	0.693
2	4,338	3,630	0.837
3	3,798	4,501	1.185
4	3,928	3,817	0.972
5	3,721	4,051	1.089
6	3,691	3,036	0.823
7	3,439	3,621	1.053
8	5,609	4,234	0.755
9	2,800	3,502	1.251
Military Installation Weighted Average			0.949

Table 2-3 shows the confidence intervals at 80% and 90% for the realization rate for Military Installations, of 0.949.

Table 2-3
Confidence Interval of Realization Rates
For Hours of Operation

Realization rate	0.949
90% Confidence interval	±0.015
80% Confidence interval	±0.012

3 METHODOLOGY

3.1 INTRODUCTION

This section described the approach used to estimate realization rates for the *Governmental Sector Hours of Operation Monitoring Study*. The study was comprised of short monitoring of the hours of operation of Governmental lighting retrofit projects installed during the 1994 program year and the estimation of a realization rate for the lighting hours of operation.

3.2 SAMPLE

Program tracking data base extracts from SDG&E's 1994 DSM program was the basis for developing the sample for the monitoring period. A total of 1,803 measure records from nine Governmental projects were included in the extract. These records totaled 6,785,055 kWh's in energy savings, based on the *ex ante* estimates from the tracking system.

Table 3-1 shows summary data for the *1994 Commercial Energy Efficiency Incentives Program First Year Load Impact Evaluation of Military Installations.*

Table 3-1
Summary Data
1994 Military Installations

Base ID #	*Ex Ante* Energy Savings	Number of Measure Records	Share of Total Base kWh Savings
1	1,082,158	751	0.159
2	1,228,386	378	0.181
3	1,105,064	289	0.163
4	78,123	51	0.012
5	37,760	31	0.006
6	44,775	52	0.007
7	2,147,453	145	0.316
8	266,394	20	0.039
9	794,942	86	0.117
Total	6,785,055	1,803	1.000

Individual buildings at each Base were identified for monitoring from building lists generated from the data base extracts. The selection was based on the *ex ante* kWh savings, building size, building use, and project size. Table 3-2 shows the number of share of *ex ante* kWh savings and number of buildings monitored for each Base.

Table 3-2
Share of *Ex Ante* Savings and Number of Monitored Buildings

Base ID #	Share of *Ex Ante* kWh Savings	No. Bldgs Monitored
1	0.159	10
2	0.181	6
3	0.163	12
4	0.012	3
5	0.006	3
6	0.007	2
7	0.316	10
8	0.117	5
9	0.039	3
Total	1.000	54

3.3 MONITORING

During the first two weeks of January 1996, each of the 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 based on room type could be estimated. The location of the logger, logger identification number, date, and time of installation were noted to facilitate logger pick up.

Loggers were left installed for two to three weeks following installation. The loggers were then retrieved and the data entered into the database.

3.4 REALIZATION RATE ESTIMATION

This section describes the estimation of the realization rate for hours of operation at Military Installations.

3.4.1 Annual Hours of Operation

The average hours of operation per day figure was determined for each logger. Weights for each logger were estimated based on estimates of each room type in the building. For example, a logger installed in a resident room in a barracks 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, which were annualized.

The annualized hours of operation were estimated by taking a weighted average of the annualized hours for each of the monitored buildings. The weights were based on the *ex ante* energy savings for the buildings monitored. The buildings monitored represented almost two-thirds of the *ex ante* energy savings. Similarly, weighted averages of the *ex ante* hours of operation were taken for each project.

3.4.2 Estimation of Realization Rates For Hours of Operation

The realization rates for hours of operation is based on Equation 3-1.

(Eq. 3-1)

$$R = \frac{H_{Verified}}{H_{ExAnte}},$$

where,

R = *Retention rate,*

$H_{Monitored}$ = *Hours estimated through monitoring, and*

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

Realization rates were calculated for each project and weighted to the Military Installation level based on *ex ante* energy savings.

One application of the realization rate is to adjust the *ex ante* hours of operation in the program tracking database by the realization rate and recalculating the savings based on the adjusted hours of operation.

MISCELLANEOUS MEASURES BY XENERGY

1994 COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM

NONMISCELLANEOUS MEASURES

ONSITE VERIFICATION STUDY

Prepared for

San Diego Gas & Electric
San Diego, California

Prepared by

XENERGY Inc.
San Diego, California

February 1996

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XENERGY

1 INTRODUCTION

1.1 INTRODUCTION

San Diego Gas & Electric (SDG&E) commissioned XENERGY Inc. to investigate the retention of Nonmiscellaneous measures installed as part of its *1994 Commercial Energy Efficiency Incentives Program (EEI Program)*. These measures were installed to provide resource value by improving the energy efficiency of the facilities that participated in the *EEI Program*. XENERGY conducted the *1994 Commercial Energy Efficiency Incentive Program Onsite Verification Study of Nonmiscellaneous Measures* on 1994 commercial sector *EEI Program* participants that installed measures categorized as Nonmiscellaneous.

The overall objectives of the study were to:

- Verify the physical installation of the measures identified in the program tracking system (electronic and hard copy);
- Investigate reasons at the site for a measure not installed; and
- Investigate possible reasons for changes in operations or facilities which may result in unusual realized savings estimates.

XENERGY utilized an on-site survey methodology that relied on the direct observation of the installed measure to verify the installation.

The remainder of this report is organized as follows:

Section 2	Results and Findings
Section 3	Methodology
Section 4	Sampling Approach

2 RESULTS

2.1 INTRODUCTION

The *1994 Commercial Energy Efficiency Incentives Program Onsite Verification Study of Nonmiscellaneous Measures* was conducted on program participants that installed Nonmiscellaneous measures during the 1994 program year.

Program data and files had been reviewed and categorized as Miscellaneous or Nonmiscellaneous by SDG&E. XENERGY used both electronic and hard copy files to provide the basis for verifying the measures installed at the site.

Descriptions of the methodology used for this study are included in Section 3. The sampling approach is discussed in Section 4. Measure installations were verified through on-site surveys.

2.2 FINDINGS

This section presents the findings of the *1994 Commercial Energy Efficiency Incentive Program Onsite Verification Study of Nonmiscellaneous Measures*. These measures were comprised of lighting and HVAC retrofits. As shown in Table 2-1, the sample frame Study was composed of 141 sites that were in the sample frame for the Program, over 99,000 individual measures, and represented almost 29 GWh in energy savings.

Table 2-1
Nonmiscellaneous Measure
Sample Description

		No. Measures		kWh Savings			
	Sites	Lighting	HVAC	Lighting	HVAC	Total	Percent of Total
Total Program	141	98,991	341	22,717,734	6,230,437	28,948,171	100%
Class 1	49	21,854	248	7,060,371	3,165,173	10,225,544	35%
Class 2	50	41,290	65	15,657,363	3,065,264	18,722,627	65%
Total surveyed	99	63,144	313	14,313,880	3,259,511	17,573,391	61%

As discussed in Section 4, the participants were assessed and placed into two classes for the study. Assignment to the classes was based on a preliminary realization rate for each participant. Refer to Section 4.2 for the assignment rules.

Table 2-2
Sample Classes
Nonmiscellaneous Measures

	Class 1	Class 2
Number of Sites	60	81

Retention rates are used to describe the extent of the verified installations. The retention rates take the form shown in Equation 2-1.

(Eq. 2-1)

$$R = \frac{Q_{Verified}}{Q_{Tracking}},$$

where,

R = *Retention rate,*

$Q_{Verified}$ = *Quantity verified, and*

$Q_{Tracking}$ = *Quantity from tracking system.*

The retention rate was examined from two perspectives, the retained energy savings and retained equipment.

2.2.1 Retention Rates: Equipment Perspective

Table 2-3 shows that a retention rate of over 98 percent for all measures was estimated. The realization rates did not differ significantly by the enduse. As shown in Table 2-4 the realization rates were essentially the same for the two Classes.

Table 2-3
Nonmiscellaneous Measure Retention Rate
By Enduse
Equipment Perspective

	Program	Surveyed	Verified	Retention Rate	90% Confidence Interval
Total	99,332	63,459	62,361	0.983	± 0.00002
Lighting	98,991	63,144	62,051	0.983	± 0.00007
HVAC	341	313	310	0.990	±0.000002

Table 2-4
Nonmiscellaneous Measure Retention Rate
By Class and Enduse
Equipment Perspective

		Program	Sample	Verified	Realization Rate	90% Confidence Interval
Class 1	Total	34,015	22,102	21,694	0.982	± 0.00001
	Lighting	33,760	21,854	21,446	0.981	± 0.00002
	HVAC	255	248	248	1.000	N/A
Class 2	Total	65,317	41,355	40,667	0.983	± 0.00014
	Lighting	65,231	41,290	40,605	0.983	± 0.00016
	HVAC	86	65	62	0.954	± 0.00008

2.2.2 Retention Rates: Energy Savings Perspective

The energy savings from the program tracking system for each measure installed was used as the indicator of the magnitude of the resource value of a measure. The retention rates from the energy savings perspective are a little lower than those from the equipment perspective, but are still very high. As shown in Table 2-5, the overall retention rate from the energy savings perspective is 0.969, indicating that almost 97 percent of the energy savings of the measures installed remain in place. The retention rates are higher for HVAC than for lighting. Table 2-6 shows that there are no discernible differences in the retention rates for Class 1 or Class 2, due in large part to the high overall retention rates.

Table 2-5
Nonmiscellaneous Measure Retention Rate
By Enduse
Energy Savings Perspective

	Program	Surveyed	Verified	Retention Rate
Total	28,948,171	17,573,391	17,028,518	0.969
Lighting	22,717,734	14,313,880	13,777,728	0.963
HVAC	6,230,437	3,259,511	3,250,790	0.997

Table 2-6
Nonmiscellaneous Measure Retention Rate
By Class and Enduse
Energy Savings Perspective

		Program	Surveyed	Verified	Realization Rate
Class 1	Total	10,225,544	8,119,195	7,986,078	0.984
	Lighting	7,060,371	5,458,746	5,325,629	0.976
	HVAC	3,165,173	2,660,449	2,660,449	1.000
Class 2	Total	18,722,627	9,454,196	9,043,440	0.957
	Lighting	15,657,363	8,855,134	8,452,099	0.954
	HVAC	3,065,264	599,062	590,341	0.985

2.2.3 Discrepancy Analysis

With retention rates over 0.98 from the equipment perspective, the relative number of missing measures is low, as shown in Table 2-3. This finding is consistent with the results of recent nonresidential DSM measure retention studies performed for SDG&E[1] and PG&E[2]. In these two studies, the retention rates for lighting measures was greater than 0.92, while the retention rates for HVAC measures were essentially 1.00.

[1] San Diego Gas & Electric's DSM Measure Retention Pilot Study, XENERGY Inc., December 23, 1994.

[2] Pacific Gas & Electric's 1990-1993 Nonresidential Retrofit Measure Retention Study, XENERGY Inc., March 30, 1995.

There was no single, definitive reason for the unverified equipment. Several possible explanations are possible:

- With the magnitude of some of the retrofit installations, there could have been some miscounts on the part of the installation or the surveyor.
- The equipment may not have been installed.
- The tracking system value may have been in error.

HVAC measures were comprised of major equipment, which, if installed properly, is seldom removed. In addition, HVAC equipment is usually more identifiable and quantifiable than lighting equipment. In spite of the greater difficulties inherent in verifying the installation of lighting measures, the lighting end use had overall retention rates over 0.95 from both the equipment and energy savings perspectives. This value is consistent with findings from previous measure retention studies for SDG&E and PG&E.

Renovation or remodeling was not a factor in the removal of energy efficient equipment incentivized through the 1994 Commercial EEI program. This finding differs from the previous studies, but is probably due to the shorter elapsed time between the retrofit and the verification surveys.

3 METHODOLOGY

3.1 OVERVIEW

This section describes the methodology used for conducting the *1994 Commercial Energy Efficiency Incentives Program Onsite Verification Study Of Nonmiscellaneous Measures.* The major tasks conducted were the:

- Review of existing site documentation, usually comprised of electronic program tracking data and hard copy files;
- Scheduling an on-site survey visit;
- Conduct the on-site verification survey;
- Perform database management; and
- Analysis and reporting.

3.2 PROCEDURES

This section describes the tasks performed to conduct the *1994 Commercial Energy Efficiency Incentives Program Onsite Verification Study of Nonmiscellaneous Measures.*

3.2.1 Task 1: Review of existing site documentation

To assemble a site profile that was as complete as possible, existing site documentation was compiled and reviewed. The documentation consisted of electronic database extracts of the *EEI Program* tracking system, as well as hard copy program files with information such as applications, energy analysis, and technical information on the measures. This information helped to ascertain the location of the measures, site contact, and accurate description of the measures. These steps facilitated the site recruitment and scheduling, as well as the on-site survey.

3.2.2 Task 2: Sample Development

The sample frame was developed as described in Section 4.

3.2.3 Task 3: Schedule on-site survey visit

The site was typically recruited and scheduled for the on-site survey by telephone. In a few instances, a current contact could not be located. In these cases, the site was visited as a "cold call."

3.2.4 Task 4: Conduct the on-site verification survey

The on-site surveys were conducted to verify the installation of the measures. In most cases, measures were counted. For some facilities, the extent of the measure installation was estimated through customer report or an extrapolation of the surveyor's observation. Data were recorded on structured data collection forms.

3.2.5 Task 5: Perform database management and analysis tasks

Data gathered during the on-site survey were entered into a data management system for analysis. Quality control routines were executed to assure the quality of the data, including customer callbacks to verify some values.

3.2.6 Task 6: Analysis and Reports

Retention rates are used to describe the extent of the verified installations. The retention rates take the form shown in Equation 3-1.

$$R = \frac{Q_{Verified}}{Q_{Tracking}}, \qquad \textit{(Eq. 3-1)}$$

where,

R = *Retention rate,*

$Q_{Verified}$ = *Quantity verified, and*

$Q_{Tracking}$ = *Quantity from tracking system.*

The retention rate was examined from two perspectives, retained energy and retained equipment.

4 SAMPLING APPROACH

4.1 INTRODUCTION

This describes the sampling approaches used for the *1994 Commercial Energy Efficiency Incentives Program Onsite Verification Study of Nonmiscellaneous Measures.*

4.2 SAMPLING: NONMISCELLANEOUS MEASURES

Nonmiscellaneous measures for 1994 were lighting and HVAC measures. Measures included in the Nonmiscellaneous category are shown in Table 4-1.

Table 4-1
Nonmiscellaneous Measures Installed in 1994

End Use	Measure Description
HVAC	High efficiency DX Air handler motors, ASD Economizers Cooling tower modifications Condensors CO sensors, fan controllers Pumps, ASD Controls
Lighting	Compact fluorescents Lamps Electronic ballasts Delamping Metal halide LED exit signs Controls

Billing data were reviewed to determine the extent to which the general load reductions may be observable through a detailed analysis. Preliminary realization rates were used to categorize the Nonmiscellaneous participants. Those customers that had a preliminary realization rate that was either high or low was included in

the verification study. Through this review process potential customer sites were placed into two classes. Class 1 was composed of sites where the realization rate indicated that the *ex ante* energy savings could not be observed through a preliminary analysis. Class 2 was composed of those sites where there the savings were on the high side, that is, the energy savings were greater than expected.

Table 4-2
Classes Based On Realization Rate
Nonmiscellaneous Measures

	Class 1	Class 2
Number of Sites	60	81

A total of 141 sites comprising 99,332 individual measures were included in the sample frame. Of the individual measures, the majority, 99 percent, were lighting measures. The remaining were HVAC measures.

Our sampling approach called for the on-site verification of measures installed at 50 sites selected at random from each of the two Classes. A total of 100 sites was surveyed. Surveys were actually completed at 99 sites: 49 Class 1 sites, and 50 Class 2 sites.

M&E PROTOCOLS TABLE 6

RESULTS USED TO SUPPORT PY94 SECOND EARNINGS CLAIM

FOR

COMMERCIAL ENERGY EFFICIENCY
INCENTIVES PROGRAMS
FIRST YEAR LOAD IMPACT EVALUATION

FEBRUARY 1996

STUDY ID NO. 923

SAN DIEGO GAS & ELECTRIC

M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY94 SECOND EARNINGS CLAIM FOR THE COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM

FIRST YEAR LOAD IMPACT EVALUATION, FEBRUARY 1996, STUDY ID NO. 923

Designated Unit of Measurement: LOAD IMPACTS PER SQUARE FOOT PER 1,000 HOURS OF OPERATION

END USE: INDOOR LIGHTING ONLY

				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	9.73	8.71	8.19	11.27	6.88	10.54	8.53	10.93	7.28	10.13
	A. ii. Load Impacts - kWh	45,594	40,813	38,387	52,801	32,242	49,384	39,977	51,211	34,133	47,493
	B. i. Load Impacts/designated unit - kW	0.000440	0.000390	0.000371	0.000509	0.000308	0.000472	0.000386	0.000494	0.000326	0.000454
	B. ii. Load Impacts/designated unit - kWh	0.44	0.39	0.37	0.51	0.31	0.47	0.39	0.49	0.33	0.45
	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	96.4%	96.4%	81.1%	111.7%	81.1%	111.7%	84.5%	108.3%	84.5%	108.3%
	D.A. ii. Load Impacts - kWh, realization rate	96.4%	96.4%	81.1%	111.7%	81.1%	111.7%	84.5%	108.3%	84.5%	108.3%
	D.B. i. Load Impacts/designated unit - kW, real rate	96.4%	96.4%	81.1%	111.7%	81.1%	111.7%	84.5%	108.3%	84.5%	108.3%
	D.B. ii. Load Impacts/designated unit - kWh, real rate	96.4%	96.4%	81.1%	111.7%	81.1%	111.7%	84.5%	108.3%	84.5%	108.3%
3. Net-to-Gross Ratios		RATIO		RATIO	RATIO			RATIO	RATIO		
	A. i. Average Load Impacts - kW	89.5%		79.2%	99.8%			81.5%	97.5%		
	A. ii. Average Load Impacts - kWh	89.5%		79.2%	99.8%			81.5%	97.5%		
	B. i. Avg Load Impacts/designated unit of measurement - kW	88.6%		81.5%	95.8%			83.0%	94.2%		
	B. ii. Avg Load Impacts/designated unit of measurement - kWh	88.6%		81.5%	95.8%			83.0%	94.2%		
	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	22,296	25,162	19,822	24,770	20,144	30,181	20,368	24,224	21,251	29,073
	B. Post-install average value HOURS OF OPERATION	4,687	3,935	4,558	4,816	3,713	4,157	4,586	4,788	3,762	4,108
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	***	***								

NOTE: Realization rate was calculated from the impact evaluation as the estimated impact divided by the *ex ante* estimate; NOT as the load impact fom the study divided by the first year earnings claim.
This was done because of an error in the DUOM calculation in the first year earnings claim; it will be corrected in the MAY 1, 1996 AEAP Filing.

*** Due to the volume of information, Measure Count Data and Market Segment Data are presented on the following pages.

SAN DIEGO GAS & ELECTRIC

M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY94 SECOND EARNINGS CLAIM FOR THE COMMERCIAL ENERGY EFFICIENCY INCENTIVES PROGRAM

FIRST YEAR LOAD IMPACT EVALUATION, FEBRUARY 1996, STUDY ID NO. 923

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

END USE: HVAC ONLY

				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	8.62	9.36	5.77	11.46	6.49	12.24	6.40	10.83	7.12	11.60
	A. ii. Load Impacts - kWh	63,962	69,515	42,833	85,091	48,186	90,844	47,495	80,429	52,893	86,137
	B. i. Load Impacts/designated unit - kW	0.000105	0.000133	0.000070	0.000140	0.000098	0.000168	0.000078	0.000132	0.000106	0.000161
	B. ii. Load Impacts/designated unit - kWh	0.78	0.99	0.52	1.04	0.73	1.25	0.58	0.98	0.79	1.19
	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	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	D.A. ii. Load Impacts - kWh, realization rate	N/A	N/A	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	91.8%	116.6%	61.5%	122.2%	86.2%	146.9%	88.2%	115.5%	92.9%	140.2%
	D.B. ii. Load Impacts/designated unit - kWh, real rate	91.8%	116.5%	61.4%	122.1%	86.1%	146.8%	88.1%	115.4%	92.8%	140.1%
3. Net-to-Gross Ratios		RATIO		RATIO	RATIO			RATIO	RATIO		
	A. i. Average Load Impacts - kW	108.7%		103.3%	114.1%			104.5%	112.9%		
	A. ii. Average Load Impacts - kWh	108.7%		103.3%	114.1%			104.5%	112.9%		
	B. i. Avg Load Impacts/designated unit of measurement - kW	126.9%		117.9%	136.0%			119.9%	134.0%		
	B. ii. Avg Load Impacts/designated unit of measurement - kWh	126.9%		117.9%	136.0%			119.9%	134.0%		
	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	81,929	26,737	63,940	99,918	21,915	31,560	67,909	95,948	22,979	30,496
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	***	***								

NOTE: kW impact factor derived from the ratio of the first year earnings claim of kW to kWh as described in the report.

*** Due to the volume of information, Measure Count Data and Market Segment Data are presented on the following pages.

Commerical Energy Efficiency Incentives Program

Measure Cost Data:

LIGHTING:

Quantity	Total Cost	Measure Descriptions
80	$7,602.29	(2) Lamp-13 Watt Compact Fluorescent Fixtures
	$36,569.49	Dimming System
	$2,273.37	Exit Sign Retrofit
1	$14,282.00	EMS & Demand Limiting of A/C
1182	$3,255.94	Halogen IR Lamps
28	$23,500.00	High Eff Fluorescent & Metal Halide Lighting
199	$16,877.15	High Pressure Sodium 200
3	$5,726.49	Install lighting timeclock
5	$1,000.00	Install Individual Switches on Tennis Li
	$5,420.18	Lighting Retrofit
	$5,746.46	Lighting Retrofit (1x8, 2 to 1)
199	($18,546.63)	Lighting-Retrofit Metal Halide
85	$55,453.72	Lighting-Retrofit Metal Halide 1XU
20	$537.00	LED Exit Signs (20 x 8.1 Watts)
48	$19,649.15	Metal halide lighting 1XU
11	$2,429.20	Metal Halide Lamps
2	$3,101.03	Photocell controls
9	$2,730.89	Photocell Controls
3	$1,069.00	Timeclocks
1	$4,200.00	Trans/Con Lighting Controller
43	$1,137.46	Twist Timers
3	$0.00	0F48V/0B6-ST
2	($38.44)	0F72/0B6-EE
11		0F72V/0B6-ST/1DLAMP6
13	($821.00)	0F96H/0B8-HO/2DLAMP8
20	$400.00	0I100A3
9		0I150A/1DLAMP
16	$4,590.06	0MV1000
52	($1,240.70)	1 Lamp-13W Compact Flourescent Fixtures-Screw In
118		1CC20H
496	$6,716.37	1CC22H
740	$12,905.80	1CC32H
1	$94.57	1CC32H/0B2-ST
4	$440.99	1CC32H/0B4-ST
3	$76.16	1CFL40H
3027	$64,748.08	1CFQ13H
28	$513.86	1CFQ13H/1B-COMPCT
20	$246.33	1CFQ13S
3	$91.95	1CFQ16H
271	$291.49	1CFQ18H
208	$12,528.84	1CFQ22H
37	$1,453.58	1CFQ22H/1B-COMPCT
1173	$34,696.23	1CFQ26H
170	$4,267.49	1CFQ28H
56	$45.74	1CFQ9H
4506	$1,871.21	1CF13H
168	$5,909.87	1CF18H
1	$28.75	1CF18H/1B-COMPCT
741	($4,065.94)	1CF5H
827	$10,204.38	1CF7H
1651	($58,972.69)	1CF9H
73	$759.16	1CF9S
16	$320.39	1FO25/.25B3-EL
60	$759.05	1FO25/.33B3-EL
28	$943.98	1FO25/.5B3-EL
40	$225.29	1FO25/.5B3-T8
22	$596.04	1FO25/.5B3-T8/1R3-D1
309	$6,597.82	1FO25/1B3-EL
28	$632.91	1FO25/1B3-EL/1DLAMP
280	$4,953.19	1FO25/1B3-T8
9	$410.34	1FO25/1B3-T8/1R3-D1
72	($4,606.47)	1FO32
9	$191.55	1FO32/.3B4T8-3L
144	$2,767.04	1FO32/.33B4T8-3L
720	$10,514.66	1FO32/.5B4T8-2L
244	$7,236.43	1FO32/1B4T8-2L
214	$3,925.72	1FO40/.5B5-EL
10	$12.82	1FO40/1B5-EL
2	($892.06)	1FO72/1B6-EL
4	($138.62)	1F48/1B6-ST/1DLAMP6
2	$11.17	1F48E/.5B6-ST
318	$13,736.00	1F72/.5B6-EL
24	$1,487.95	1F96E/1B8-EE
3	$299.96	1F96E/1B8-EE/1R8-D0
78	$6,152.87	1F96E/1B8-EE/1R8-D1
1	$51.94	1F96E/1B8-EL
10	$809.33	1HP100
39	$11.55	1HP150
29	$6,081.47	1HP150/0B4-ST
7	$1,259.96	1HP35/0B4-ST
8	$1,263.87	1HP35/0B8-ST
90	$7,356.78	1HP50

HVAC:

Quantity	Total Cost	Measure Descriptions
1	$1,529.00	(1) 2-Ton & (1) 5-Ton split system units
2	$44,100.00	A/C Unit
1	$1,220.50	A/C: DX Hi Eff<65MBH,SEER=10.9
103	$139,414.00	A/C: DX High Efficiency Unit
1	$800.00	Additional EMCS Control (Condenser Water Pump)
2	$6,034.00	ASD on cooling tower fans (2x20HP)
1	$32,718.00	ASD on Air Handler (150, net)
1	$5,395.00	ASD on Air Handler Motor
1	$32,718.00	ASD on Air Handlers (150, net)
1	$22,563.00	ASD on Air Handlers (120, net)
1	$32,718.00	ASD on Air Handlers (150, net)
2	$16,417.00	ASD on Air Handlers (2x60HP)
1	$16,868.00	ASD on Air Handlers (56, net)
3	$20,794.00	ASD on Cooling Tower
1	$10,700.00	ASD on Hot Water Pump
2	$15,222.00	ASD's for Air Handlers (2x40 HP)
2	$14,150.00	ASD's on Cooling Tower Fans (2x30HP)
8	$45,074.00	ASDs
4	$20,033.00	ASDs (various hp: 2x15 & 2x25)
6	$35,057.00	ASDs (various hp:1x7.5,2x20,1x25,1x50 &
8	$46,555.00	ASDs (4x60HP supply fans & 4x15HP return fans
1	$111,500.00	Centrifugal High Efficiency Chiller
	$37,400.00	Change CHW System to Primary-Secondary w/ ASD
1	$725,000.00	Chilled Water System w/ VAV
2	$104,443.42	Chiller: Centrifugal High Eff
1	$1,220.00	Chiller: OTHER
3	$120,143.00	Chiller: 50<=Air Cool<100 ton
1	$5,290.00	Co Monitors & Garage Fan Controller
1	$12,878.92	CO Monitor & Garage Fan Controller
2	$2,995.00	CO Monitor with Two Sensors
1	$2,172.00	CO Monitors & Garage Fan Controller
12	$28,174.46	CO Sensor
2	$48,412.84	CO Sensor & Garage Fan Controller
4	$5,925.00	C0 Monitors & Garage Fan Controllers
6	$9,720.00	C0 Sensors-Monitoring System in Garage
1	$5,050.00	Economizer (Trane) for CW Air Handler
3	$10,000.00	Economizer & R.A. Ducts on multiple air handlers
34	$39,015.90	Economizer Installation
1	$1,500.00	Economizer Repair
28	$22,774.00	Economizer Repair (On air side for chiller)
3	$4,107.47	Economizer(Motorized damper control system)
2	$6,800.00	Electronic Expansion Valves for 2x80ton Chillers
1	$1,500.00	Energy Management System
1	$18,796.35	Evaporative Condenser (85 degrees operational temp
	($200,000.00)	Evaporative Cooling (See Comments for Detail)
1	$3,266,000.00	EMS (direct digital)
1	$6,800.00	EMS-Timeclock on W S Heat Pump System
2	$3,810.00	EVAPCO ATW 226 Coolers
1	$20,000.00	Gas Engine Driven Chiller
10	$4,890.00	Heat Pump: OTHER
1	$3,900.00	Heat Pump: WaterSrc <=24 MBH
1	$600.00	Heat Pump: WaterSrc 24-65 MBH
2	$1,400.00	Hi Ef Motors (2x75HP) Nominal Ef. 94-5
43	$11,695.05	Hi Eff Electric Motors on HVAC Vent/Fans
4	$12,000.00	High efficiency air conditioning
1	$58,575.00	High Efficiency Air-Cooled Chiller
1	$562.00	Install (1) 4 Ton gas package unit (12 SEER)
10	$6,000.00	Install economizers on the new 15 ton units.
2	$900.00	Install economizers on the new 4 ton units.
4	$2,200.00	Install economizers on the new 5 ton units.
1	$25,275.00	Install solar film
1	$8,120.00	Install CO monitor to control ventilation fan oper
1	$7,040.00	Install CO Monitor to control ventilation fan oper
1	$25,000.00	Install Solar Film on 10,000 SqFt of Windows
4	$5,884.00	Install 4 CO Sensors to control 8 ventilation fans
1	$4,250.00	ODP Motor 3HP - 10HP
1	$5,116.00	Pony motor for cooling tower fan.
1	$5,000.00	Remove existing conditioner
1	$1,200.00	Repair the non-operable economizer on the 40 ton u
2	$2,400.00	Replace package A/C with a high effiency unit (4 T
1	$6,000.00	Replace pkg A/C w high efficiency split system (10
7	$42,000.01	Replace pkg A/C w high Efficiency units (10 ton un
2	$18,000.00	Replace pkg A/C w High Efficency Units (15 ton uni
1	$24,000.00	Replace 70 ton Admin A/C unit w a 40 Ton High Effi
1	$21,250.00	Solar Film on 8547 Sq. Ft. of Window Space
	$19,705.00	Solar Reflecting Window Film
1	$9,000.00	Solid State Controls & Pneumatic Transducers
2	$4,557.66	Static Pressure Sensors/Controllers on ASD
1	$5,687.00	Thermal Energy Storage
1	$9,475.00	Thermal Insulation for Dish Wash Machine
1	$84,952.00	Timeclock A/C
207	$8,759.00	Timeclocks

COOKING:

Quantity	Total Cost	Measure Descriptions
2	$13,834.58	Convection Oven
4	$24,708.44	Convection Ovens (Selectronic II)
1	$2,655.00	Gas Convection Oven
1	$4,515.00	Gas Infrared Rostisserie

MISC:

Quantity	Total Cost	Measure Descriptions
1	$262.00	A/C: DX High Efficiency Unit
1	$12,213.00	Compressor
1	$48,751.28	Energy Efficient swimming pool pump
1	$3,190.00	EMS on hot water system
1	$4,690.00	EMS on the hot water recirc system
1	$41,698.00	Hi-efficiency Natural Gas Dryer
3	$6,000.00	High Efficiency Washers (460lb)
1	$3,190.00	Install EMS on DHW system.
1	$15,000.00	Laundry heat recovery system-(Pumps 4x1
1	$46,808.00	Pacesetter High Efficiency Dryer
2	$3,166.32	Pool Boilers
1	$5,995.00	Pool Cover
1	$4,190.00	Pro-Temp Computerized Heater Controller
1	$2,000.00	Remove line voltage conditioner
3	$25,783.80	Thermastak Heat Recovery System
2	$195.00	Timeclocks
1	$12,689.00	VFD for raw sewage pump motor
1	$12,300.00	VFD on RAS Pump Motor
12	$115,803.00	VSD/ASD on Injection Mold Machine
1	$499.00	4 Slice pop-up toaster
1	$1,557.43	Air Compressor with Air Pressure Switch
1	$10,421.00	Boiler
1	$43,030.69	C0 Monitoring System to Control Fans
1	$38,000.00	Digital Combination Press/Folder
8	$38,746.00	Heat Pump
1	$44,405.00	Hi Eff Compressor Uneven Parallel System
38	$29,000.00	Hi Eff Refrigeration Cases (866.4 cu ft)
2	$17,851.00	High Efficiency Motors (2x400HP)
1	$257,019.81	Pumping Station Pipeline Drag Reducer
1	$2,000.00	Time Clock on Oil Heating Tank
4	$196,116.00	VFDs on Chilled Water System (2x25HP & 2x50HP)
1	$13,778.00	VSD on Pump Motor
1	$4,681.55	"Premium Efficiency" Booster Pump 68.6%
1	$60,973.57	High efficiency pump & motor
1		High Efficiency Pump
2	$15,735.00	High Efficiency Water Booster Pump
1	$13,573.17	High Efficiency Water Pump
1	$8,660.67	Install High Efficiency Pump
1		Lineshaft Pump
1		Lineshaft Pump (Well #19)
1	$25,355.99	VFD Unit & Associated Controls
1	$41,013.89	VFD Unit & Association Controls
2	$60,881.38	VSD on H20 pump(2xEnergy Eff Motors & 1x
272	$109,358.00	6057 HP

Commerical Energy Efficiency Incentives Program

Measure Cost Data:

LIGHTING:

Quantity	Total Cost	Measure Descriptions
343	$18,766.61	1HP70
12	$3,460.52	1HP70/0
54	($3,553.44)	1I45PCF
154	($2,035.03)	1I45PCF3
240	$3,120.61	1I60PC3
34	$4,639.26	1LP180
2	$170.31	1MH100
33	$11,258.26	1MH175
87	$18,861.79	1MH250
18	$5,685.97	1MH400
9	$2,126.65	1MH400/0
20	($234.09)	1MV400
7	$22.29	1XCF5K
2	$36.18	1XCF9K
9	($1,108.09)	1XLEDT6
751	($168,349.69)	1XLED1
36	($14,998.67)	1XLED1P
74	($24,849.25)	1XLED2
23	($12,868.79)	1XLED2P
11	($713.32)	1XSF20
1	$3,642.08	108FO32/54B4-EL/54R4-D0
351	$1,017.86	13W Fluorescent, 130 Volt PAR Tungsten Halogen Flo
24	$1,169.25	2x70 & 3x100W High Pressure Sodium Lamps, 12x13
87	($22,789.89)	2CFQ13H
4	$167.48	2CFQ26H
36	$1,114.78	2CFQ9H
138	$1,857.67	2CF13H
14	$1,433.71	2CF18H
503	($5,735.90)	2CF5H
276	($25,562.15)	2CF7H
1011	$23,785.67	2CF9H
6	$33.93	2CF9S
64	$1,861.16	2FO17/1B2-17T8
97	$6,158.43	2FO17/1B2-17T8/1R2-D0
53	$1,092.97	2FO17/1B2-17T8/1R2-D2
100	$2,470.52	2FO25/.5B3-EL
356	$9,121.48	2FO25/1B3-EL
214	$4,469.84	2FO25/1B3-T8
154		2FO32/.5B4T8-2L
152	$3,697.88	2FO32/.5B4T8-4L
176	$7,659.93	2FO32/.5B4T8-4L/1R8-D1
4	$161.73	2FO32/1B3-T8
1	($0.33)	2FO32/1B4-EE
13	$617.44	2FO32/1B4-EL
4101	$109,847.52	2FO32/1B4T8-2L
532	$24,624.03	2FO32/1B4T8-2L/1DLAMP8
261	$17,392.36	2FO32/1B4T8-2L/1R4-D0
205	$9,583.57	2FO32/1B4T8-2L/1R4-D1
255	$18,341.45	2FO32/1B4T8-2L/1R4-D2
391	$20,451.88	2FO32/1B4T8-2L/1R8-D0
911	$39,776.54	2FO32/1B4T8-2L/1R8-D1
161		2FO32/1B4T8-2L/2R4-D0
401	$13,317.88	2FO32/1B4T8-2L/2R4-D1
60	$3,694.28	2FO32/1B4T8-2L/2R4-D2
531	$33,754.00	2FO40/1B5-EL/1R5-D0
1	$38.24	2F34/1B4-EE
104	$5,270.00	2F34/1B4-EE/1R4-D2
75	$2,821.45	2F4T1/1B4-ST
4	($1,045.01)	2F48E/1B6-EL
91	$2,978.38	2F72/1B6-EL
10	$2,001.20	2F72/1B6-HO
17	$1,353.74	2F96E/1B8-EE/1R8-D0
2	$103.53	2F96E/1B8-EE/1R8-D2
200	$9,161.79	2F96E/1B8-EL
5	$130.00	2I60PC3
159	($712.70)	2XEL
9	($313.63)	2XLED1
150	$15,546.79	3ft T-8 Lamps w/ Standard Ballasts
54	$1,054.35	3CF13H
309		3FO25/2B3-EL
200	$11,941.11	3FO32/1B4T8-3L
25	$905.05	3FO32/1B4T8-3L/1DLAMP
6	$327.18	3F72/2B6-EL
8	$145.78	4CF13H
13	$618.83	4FO25/1B3-EL
793	$21,983.69	4FO25/1B3-T8
156	$22,617.74	4FO25/2B3-EL
37	$3,398.26	4FO32/1B4-EL/1R8-D2
348	$20,271.02	4FO32/1B4T8-2L
2	$91.56	4FO32/1B4T8-2L/1R8-D2
9327	$518,087.35	4FO32/1B4T8-4L
5	$196.59	4FO32/1B4T8-4L/1R4-D0
18	$1,174.64	4FO32/1B4T8-4L/1R4-D1

HVAC:

Quantity	Total Cost	Measure Descriptions
34	$2,676.38	Timeclocks on AC (Paragon)
1	$24,380.40	Tinted Glazing
1	$2,424.38	Two Speed Motor on Air Handler
1	$190,000.00	Variable speed pump motor drives
1	$26,447.00	VFD on Chilled Water Pump
1	$7,050.00	VFD on 15 HP Motor
1	$9,892.00	VFD to control two cooling tower motors
1	$12,445.00	VFD Hot Water Pump
1	$16,636.52	VFD Unit & Associated Controls
4	$32,950.00	VFDs on Air Handler Mtrs(2x50,1x40,1x30HP)
1	$9,621.58	VSD for Cooling tower fan
1	$5,557.00	VSD for Cooling Tower Fan
1	$10,357.50	VSD on cooling tower evap. condenser fan
1	$11,521.00	VSD on cooling tower fan
2	$13,400.00	VSD on the Cooling Towers(1x30HP & 1x50HP)
1	$3,151.69	VSD on 30HP Supply Fan
1	$50,409.00	VSD w/ bypass switch
4	$38,341.00	VSD/ASD for Motors
3	$205,000.00	VSD's for Fume Hoods (1x20, 1x50, 1x75HP)
4	$21,000.00	VSD's for 1-30HP & 1-25HP Fan Motors
2	$10,000.00	VSD's for 1-40HP & 1-7.5HP Fan Motors
2	$11,000.00	VSD's for 1-50HP & 1-10HP Fan Motors
3	$24,000.00	VSD's for 3-20HP Fan Motors
3	$16,000.00	VSD's on 2-20HP & 1-25HP Fan Motors
1	$3,232.50	2 Speed Motor on Air Handlers
2	$17,444.00	2 VSD's on 4x20HP Cooling Tower Fans
1	$5,000.00	5 HP High efficiency Pump
1	$734.64	A/C: DX High Efficiency Unit
1	$304.73	Heat Pump
1	$1,462.68	High Efficiency Air Conditioner
1	$5,882.90	High Efficiency Chiller (.565kw/ton)
1	$6,504.80	High Efficiency Chiller .565kw/ton
2	$6,090.52	High Efficiency Chillers (2x215Ton)
2	$826.67	Economizer Repair (on air handlers 1 & 2
2	$826.67	Economizer Repair (total 120 Tons)
1	$117.54	A/C: DX High Efficiency Unit
1	$220.39	A/C: DX High Efficiency Unit
1	$293.86	A/C: DX High Efficiency Unit
1	$117.54	A/C: DX High Efficiency Unit
1	$257.12	A/C: DX High Efficiency Unit
2	$881.57	A/C: DX High Efficiency Unit
1	$117.54	A/C: DX High Efficiency Unit
1	$587.71	A/C: DX High Efficiency Unit
1	$734.64	A/C: DX High Efficiency Unit
1	$198.35	A/C: DX High Efficiency Unit
2	$1,469.28	A/C: DX High Efficiency Unit
1	$198.35	A/C: DX High Efficiency Unit
7	$2,056.99	Heat Pump System, 12.0 EER
1	$564.00	Heat Pump: AirSrc 24-65 MBH

COOKING:

Quantity	Total Cost	Measure Descriptions

MISC:

Quantity	Total Cost	Measure Descriptions

Commerical Energy Efficiency Incentives Program

Measure Cost Data:

LIGHTING:

Quantity	Total Cost	Measure Descriptions	
60	$3,003.63	4FO32/1B4T8-4L/1R4-D2	
1460	$99,647.70	4FO32/1B4T8-4L/1R8-D0	
121	$8,141.98	4FO32/1B4T8-4L/1R8-D1	
154	$9,472.36	4FO32/1B4T8-4L/1R8-D2	
288	$26,724.20	4FO32/1B4T8-4L/2DLAMP8	
441	$36,926.92	4FO32/1B4T8-4L/2R4-D0	
84	$4,775.01	4FO32/1B4T8-4L/2R4-D1	
30	$1,090.70	4FO32/1B4T8-4L/2R4-D2	
25	$1,016.14	4FO32/2B4T8-2L	
9	$526.76	4FO32/2B4T8-2L/1R8-D2	
261	$20,902.63	4FO32/2B4T8-2L/2R4-D0	
2		4FO32/2B4T8-2L/2R4-D1	
196	$19,896.60	4FO32/2B4T8-2L/2R4-D2	
128	$3,806.61	4FO32/2B4T8-2L/2R4-D4	
4	$265.90	4F34/2B4-EE	
117	($5,262.91)	5, 9, & 13 watt compact fluorescents	
11	$1,438.76	6FO32/2B4T8-3L/2DLAMP8	
12	$571.23	8FO32/2B4T8-2L	
86	$6,457.49	8FO32/2B4T8-4L	
118	$1,948.32	Occupancy Sensors	
59	$1,019.53	Occupancy Sensors	
2	$374.96	Sensor: Photocells	
1	$17.28	Occupancy Sensor	
1	$29.17	Occupancy Sensor	
43	$1,254.31	Occupancy Sensors	
40	$1,166.80	Occupancy Sensors	
89	$2,596.13	Occupancy Sensors	
42	$1,225.14	Occupancy Sensors	
89	$2,596.13	Occupancy Sensors	
40	$1,166.80	Occupancy Sensors	
126	$3,675.42	Occupancy Sensors	
4	$69.12	Occupancy Sensors	
90	$1,555.21	Occupancy Sensors	
39	$673.93	Occupancy Sensors	
368	$6,076.11	Occupancy Sensors	
3	$51.84	Occupancy Sensors	
6	$103.68	Occupancy Sensors	
22	$380.16	Occupancy Sensors	
11	$190.08	Occupancy Sensors	
5	$145.85	Occupancy Sensors	
160	$2,641.79	Occupancy Sensors	
1	$29.16	Occupancy Sensors	
10	$172.80	Occupancy Sensors	
1	$29.16	Occupancy Sensors	
1	$17.74	Occupancy Sensors	
4	$116.68	Occupancy Sensors	
73	$2,129.41	Occupancy Sensors	
36	$1,050.12	Occupancy Sensors	
34	$991.78	Occupancy Sensors	
14	$241.92	Occupancy Sensors	
1	$29.16	Occupancy Sensors	
7	$204.19	Occupancy Sensors	
1	$29.17	Occupancy Sensors	
1	$29.16	Occupancy Sensors	
8	$233.36	Occupancy Sensors	
8	$233.36	Occupancy Sensors	
74	$2,158.58	Occupancy Sensors	
1	$29.16	Occupancy Sensors	
31	$904.27	Occupancy Sensors	
24	$700.08	Occupancy Sensors	
17	$495.89	Occupancy Sensors	
100	$1,651.12	Occupancy Sensors	
4	$116.68	Occupancy Sensors	
7	$204.19	Occupancy Sensors	
17	$495.89	Occupancy Sensors	
12	$198.13	Occupancy Sensors	
3	$87.51	Occupancy Sensors	
3	$87.51	Occupancy Sensors	
1	$29.17	Occupancy Sensors	
34	$991.78	Occupancy Sensors	
1	$29.17	Occupancy Sensors	
3	$87.51	Occupancy Sensors	
15	$437.55	Occupancy Sensors	
4	$116.68	Occupancy Sensors	
4	$116.68	Occupancy Sensors	
56	$1,633.52	Occupancy Sensors	
9,056	$9.06	Optical Reflector	(34)
9,189	$29.78	F17T8 Electronic Ballast	(35)
17,809	$3.19	F17T8 Lamp	(36)
7,726	$25.54	FB31T8 Electronic Ballast	(37)
12,190	$7.87	FB31T8 U-Lamp	(38)
0	$25.53	FB40T12 Electronic Ballast	(39)
0	$5.62	FB40T12/ES U-Lamp	(40)

HVAC:

Quantity	Total Cost	Measure Descriptions

COOKING:

Quantity	Total Cost	Measure Descriptions

MISC:

Quantity	Total Cost	Measure Descriptions

Commerical Energy Efficiency Incentives Program

Measure Cost Data:

LIGHTING:

Quantity	Total Cost	Measure Descriptions	
0	$26.60	F40W/T5CF Electronic Ballast	(41)
0	$7.39	F40W/T5CF Lamp	(42)
264	($4.45)	Delamping	(43) ??
0	$12.71	Replace Hybr Ballast (1992)	(44)
3,271	$24.52	Replace Elect Ballast (1992)	(45)
124,696	$24.58	High Eff Ballast T-8 (1992)	(46)
151,361	$2.25	Low Wattage Bulbs (32 Watt) (1992)	(47)
688	$0.74	Replace LW Bulb (34 WATT) (1992)	(48)
30,938	$12.38	Delamp 1/Opt Reflect (1992)	(49)
32,801	$14.12	Delamp 2/Opt Reflect (1992)	(50)
3,076	$3.38	Delamp (1992)	(51)
11,037	$17.46	4 Lamp Ballast	(52)
6,408	$18.41	3 Lamp Ballast	(53)
12,378	$29.20	High Eff Ballast 8ft (1992)	(54)
688	$30.78	Opt Reflector (1 LMP) - 8ft (1992)	(55)
463	$39.97	CF - 13 Q Downlight	(30A)
80	$20.00	CF - PL-9 Downlight	(30B)
100	$20.00	CF - PL-7 Downlight	(30C)
504	$49.00	Exit Sign 14w CF	
22	$20.00	CF - PL-5 Downlight	(30D)

HVAC:

Quantity	Total Cost	Measure Descriptions

COOKING:

Quantity	Total Cost	Measure Descriptions

MISC:

Quantity	Total Cost	Measure Descriptions

Frequency Distribution of Three Digit SIC for Commercial Sector
By Study and Enduse

Study: Lighting	SIC	Frequency
Enduse: *HVAC*	799	1
	Subtotal:	1

Study: Lighting	SIC	Frequency
Enduse: *Lighting*	074	2
	421	2
	422	1
	449	1
	472	1
	473	1
	481	1
	483	1
	494	3
	501	1
	503	1
	504	2
	506	4
	507	6
	508	3
	509	1
	512	1
	514	3
	517	3
	518	2
	519	2
	520	1
	521	1
	523	3
	525	1
	526	1
	531	7
	533	2
	539	1
	541	52
	551	8
	553	10
	554	5
	556	1
	557	2
	562	18
	565	6
	566	40
	571	6
	573	5
	581	125
	591	36
	592	3
	593	7
	594	18
	599	4
	602	8
	603	9
	608	1
	609	2
	614	1
	616	3
	621	1
	628	1
	636	1
	641	2
	651	57
	653	21
	654	1
	655	12
	679	1
	701	12
	721	4
	722	1
	723	3
	733	3
	735	3
	736	1
	737	2
	738	2
	753	2
	784	3

Study: Lighting	SIC	Frequency
Enduse: *Lighting (Cont.)*	799	9
	801	2
	802	1
	804	3
	805	2
	806	5
	809	1
	811	2
	821	19
	822	8
	823	3
	824	2
	829	3
	832	1
	835	5
	841	1
	861	4
	864	8
	866	15
	869	1
	871	4
	872	1
	873	5
	874	1
	881	1
	899	1
	911	6
	919	11
	922	4
	944	1
	971	6
	Subtotal:	698

Study: Lighting	SIC	Frequency
Enduse: *Motors*	799	1
	Subtotal:	1
	Total:	700

Study: HVAC	SIC	Frequency
Enduse: *HVAC*	481	1
	508	1
	521	1
	531	10
	533	1
	541	2
	551	1
	562	1
	581	2
	594	1
	602	2
	603	1
	631	1
	641	1
	651	11
	653	10
	655	1
	673	1
	701	11
	729	1
	733	1
	737	1
	799	2
	801	2
	808	1
	821	1
	822	6
	832	1
	864	1
	866	1
	873	6
	919	1
	Subtotal:	85

Study: HVAC	SIC	Frequency
Enduse: *Lighting*	873	2
	Subtotal:	2

Study: HVAC	SIC	Frequency
Enduse: *Misc*	508	1
	Subtotal:	1

Study: HVAC	SIC	Frequency
Enduse: *Motors*	000	1
	004	1
	494	1
	495	1
	519	1
	531	5
	533	1
	541	2
	563	1
	581	1
	602	4
	608	1
	641	1
	651	5
	653	4
	655	2
	673	1
	701	9
	737	1
	754	2
	794	1
	806	6
	821	4
	822	2
	829	1
	864	1
	873	8
	919	3
	921	1
	962	4
	Subtotal	76
	Total	164

Study: HVAC/Light	SIC	Frequency
Enduse: *HVAC*	481	1
	507	1
	531	2
	551	1
	581	1
	596	1
	651	4
	653	5
	655	1
	701	2
	801	1
	802	1
	821	3
	873	1
	911	2
	921	1
	971	2
	Subtotal:	30

Study: HVAC/Light	SIC	Frequency
Enduse: *Lighting*	481	1
	507	1
	508	1
	531	3
	551	1
	581	1
	591	1
	596	1
	641	1
	651	5
	653	5
	701	2
	737	1
	801	1
	802	1
	806	1
	821	5
	822	1
	873	2
	911	2
	921	1
	971	2
	Subtotal:	40

Study: HVAC/Light	SIC	Frequency
Enduse: *Motor*	531	1
	591	1
	641	1
	821	2
	822	2
	871	2
	943	1
	Subtotal:	10
	Total:	80

Study: Misc	SIC	Frequency
Enduse: *Misc*	495	1
	701	5
	721	3
	799	1
	866	1
	873	1
	Subtotal	12

Study: Misc	SIC	Frequency
Enduse: *Motor*	481	1
	495	1
	701	1
	799	1
	Subtotal:	4

Study: Misc	SIC	Frequency
Enduse: *Process*	421	1
	799	1
	Subtotal:	2
	Total:	18

M&E PROTOCOLS TABLE 7

DATA QUALITY AND PROCESSING DOCUMENTATION

FOR

COMMERCIAL ENERGY EFFICIENCY
INCENTIVES PROGRAMS
FIRST YEAR LOAD IMPACT EVALUATION

FEBRUARY 1996

STUDY ID NO. 923

M&E PROTOCOLS TABLE 7
DATA QUALITY AND PROCESSING DOCUMENTATION
For 1994 Commercial Energy Efficiency Incentives Program
First Year Load Impact Evaluation
February 1996
Study ID No. 923

A. OVERVIEW INFORMATION

1. **Study Title and Study ID:** 1994 Commercial Energy Efficiency Incentives Program: First Year Load Impact Evaluation and Retention Studies, February 1996, MPAP-94-P98-923-R606, Study ID No. 923

2. **Program, Program Year, and Program Description:** SDG&E offers the 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 marketing delivery mechanisms for providing incentives for retrofit or replace-on-burnout applications: (1) Commercial/Industrial 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 are lighting and space cooling.

4. **Methods and Models Used:** The main statistical method used is *ordinary least-squares regression analysis*, applied at the customer level, for participants and nonparticipants. See the modeling sections of the report for a complete detailed description of the final model specifications.

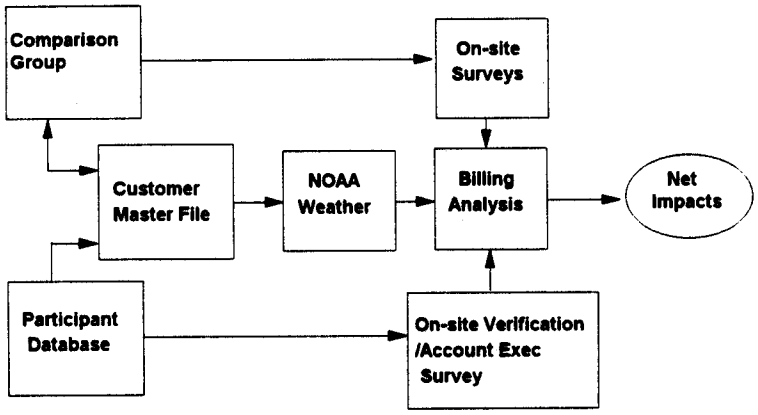
5. **Participant and Comparison Group Definition:** For the load impact analysis of the lighting and HVAC end uses, a participant was defined as a customer or group of customers with a common contract for DSM installations who completed the installation of the high efficiency measures by December 31, 1994. A non-participant was defined as a customer who did not meet the definition of a participant.

6. **Analysis Sample Size:**

End Use	No. of Participants	No. of Measures	Average No. of Billing Months
Lighting Only	690	485,081	35.5
HVAC Only	150	698	35.7
Total	740	485,779	

B. DATABASE MANAGEMENT

1. **Flow Chart:** The following diagram describes the flow of data into the final new impact results:



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

- Customer name, address, and installation date from the program tracking database;
- Comparison group 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, and occupancy from on-site audits for the comparison group;
- Information on other changes for all assigned customers in the Participant Group were obtained from a survey conducted on the account executives
- On site verification of installed measures for the Participant Group conducted by Xenergy, Inc.
- Hourly weather data for three climate zones from NOAA files; and
- Retention information on "miscellaneous measures."

3. **Data Attrition:**

a. **Participant Group:** an attempt was made to use all program participants identified with each end use. Attrition was primarily due to insufficient pre-retrofit or post-retrofit billing data per Table C-12.

Number of Participants in the Commercial Lighting Load Impact Analysis	
Number of participants in the database	690
Less Military participants	683
Estimable regression parameters	673
Participants in relevant stratum	658
Relevant stratum participants with sufficient post data	649
Relevant stratum participants with sufficient pre data	617
Relevant straum participants after elimination of bad square footage, university, & cogen site	614

Number of Participants in the Commercial HVAC Load Impact Analysis	
Number of participants in the database	150
Estimable regression parameters	146
Participants in relevant stratum	84
Relevant stratum participants with sufficient data	78
Relevant straum participants after elimination of small *ex ante* savings to large consumption	76

b. **Nonparticipant Group:** all selected nonparticipants with completed surveys were included in both analyses subject to the constraint that the customer had the end use of interest.

4. **Data Quality Checks:** The data sets for the regression analysis were merged in SAS by the appropriate key variables. Counts of the data sets before and after the merges were verified to insure accurate merging. Surveys and billing data

were merged by premise ID number. Weather data were merged by billing cycle and climate zone.

5. **For impact analyses,** only square footage and hours of operation, were used from the on-site surveys. The complete surveys for all sites will be added to SDG&E's database of commercial end use surveys (CEUS). Survey data are in PC format on diskettes.

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 (pp. 7-8).

2. **Survey Information:** Details on the results on pages 6-8 of the Overview section.

3. Statistical Descriptions:

Table 1 – Commercial Lighting Results

	Estimated Monthly kWh (< 300,000)	Estimated Monthly kWh (> 300,000)
PARTICIPANT GROUP		
Total Estimated Impact (kWh per month)	(2,332,904)	(1,070,763)
Variance of Estimate	50,250,898,931	107,467,091,412
Total *Ex Ante* Estimate of Savings (kWh per month)	2,420,720	478,078
Total Lighting Square Footage	13,689,839	3,749,072
Count	614	15
Average Annual Hours	4,687	5,163
Realization Rate (Gross Impact)	96.4%	224.0%
Standard Error of Realization Rate	9.3%	68.6%
Impact per Square Foot per 1,000 Hours	0.44	0.66
Impact per Square Foot (Annual kWh)	2.04	3.43
Average Impact (Annual kWh)	45,594	856,611
NONPARTICIPANT GROUP		
Total Estimated Impact (kWh per month)	(161,354)	(718,571)
Variance of Estimate	9,059,305,917	22,898,265,067
Total *Ex Ante* Estimate of Savings (kWh per month)	na	na
Total Lighting Square Footage	10,190,740	1,631,869
Count	405	10
Annual Hours	3,935	6,158
Impact per Square Foot per 1,000 Hours	0.05	0.86
Impact per Square Foot (Annual kWh)	0.19	5.28
Average Impact (Annual kWh)	4,781	862,286
NET-TO-GROSS		
Impact per Square Foot per 1,000 Hours	88.9%	-29.2%
Impact per Square Foot (Annual kWh)	90.7%	-54.2%
Average Impact (Annual kWh)	89.5%	-0.7%

Table 2 – Commercial Cooling Results

	400 kWh < Ex Ante Estimate < 60,000 kWh	Ex Ante Estimate < 400 kWh	Ex Ante Estimate > 60,000 kWh
PARTICIPANT GROUP			
Total Estimated Impact (kWh per month)	(405,090)	12,505	290,349
Variance of Estimate	6,617,692,959	7,392,638,539	4,448,014,161
Total Ex Ante Estimate of Savings (kWh per month)	559,046	7,648	281,803
Total Square Footage	6,226,584	9,145,460	707,442
Count	76	51	4
Realization Rate (Gross Impact)	72.5%	-163.5%	-103.0%
Standard Error	14.6%	1124.2%	23.7%
Impact per Square Foot (Annual kWh)	0.78	(0.02)	(4.93)
Average Impact (Annual kWh)	63,962	(2,942)	(871,047)
NONPARTICIPANT GROUP			
Total Estimated Impact (kWh per month)	180,938		
Variance of Estimate	3,321,569,332		
Total Square Footage	10,454,356		
Count	391		
Impact per Square Foot (Annual kWh)	(0.21)	(0.21)	(0.21)
Average Impact (Annual kWh)	(5,553)	(5,553)	(5,553)
NET-TO-GROSS			
Impact per Square Foot (Annual kWh)	126.6%	-1165.8%	95.8%
Average Impact (Annual kWh)	108.7%	-88.7%	99.4%

D. DATA SCREENING AND ANALYSIS

1. These issues are discussed in detail in the modeling and results sections of the report.

2. Adjustments were made to the regressions (regressors were added) in line with Account Executive survey results. The modeling portion of the report gives details.

3. All participants were part of the analysis regardless of the amount of billing information available since individual regression models were constructed for individual customers. All results were reviewed and decisions made. See Results (pp. 79-23) under the Lighting and HVAC section.

4. **Regression Statistics:** See item 3. under Sampling.

5. **Specification:**

a. Regressions were run at the customer level. This accounts for customer heterogeneity to the maximum.

b. Weather and trends were accounted for in the model. Also, customer-specific changes (described by SDG&E account executives) were embedded in the regression model. See the modeling portion of the report for details.

c. No explicit measures were taken for self-selection. The study follows the straightforward participant/nonparticipant framework of the M&E Protocols.

d. SDG&E believes that no regressors of any consequence have been omitted from the analysis.

e. The framework is discussed in great detail in the modeling section of the report.

6. **Errors in Measuring Variables:** Errors in variables is not a factor in the study.

7. **Autocorrelation** was not included as an element of the specification. For one, correcting for autocorrelation prohibits the use of SAS package weighting functions, which is used in the regressions to eliminate data in the neighborhood of the installation date (see the report for details). Second, autocorrelation--when left uncorrected--leaves no bias and only (in our view) a minor inefficiency in the estimates.

8. **Heteroskedasticity:** Since *ordinary least-squares regression analysis* is applied at the customer level, the variance of the regression disturbance terms can vary at the customer level, and the estimator will be efficient. No other forms of heteroskedasticity were considered.

9. **Collinearity** was a factor to some extent, especially in the cooling model. Indicator variables, trend-based regressors, and weather data, when included in the same regression, can easily lead to collinearity problems. However, this issue was not serious in the lighting model, since weather data were not a part of the DSM portion of the specification. However, weather data were part of the DSM portion of the cooling model, in which case the model began to break down due to collinearity. The report describes how the trend portion of the model was suppressed in the case of cooling, as a means of clarifying the model results.

10. **Influential Data Points:** These issues are discussed in great detail in the Results (pp. 19-23).

11. **Missing Data:** No significant amount of data were missing, except for a portion of the sample for which there was insufficient pre-installation data or insufficient post-retrofit data. See the Results section of the report for details.

12. **Precision:** Standard errors are given in the Results section of the report, and in Table 6.

E. DATA INTERPRETATION AND APPLICATION

1. **Calculation of Net Impacts:** These calculations are described in detail in the Modeling and Results sections of the report, as well as in Table 6.

2. See the Modeling and Results section of the report.