Customer Energy Efficiency Program
Measurement and Evaluation Program

IMPACT EVALUATION OF PACIFIC GAS & ELECTRIC COMPANY'S 1995 RESIDENTIAL DIRECT ASSISTANCE AND 1995 RESIDENTIAL ENERGY MANAGEMENT SERVICES PROGRAMS

PG&E Study ID numbers:
336: Residential Direct Assistance
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IMPACT EVALUATION OF PG&E'S 1995 DIRECT ASSISTANCE PROGRAM AND 1995 RESIDENTIAL ENERGY MANAGEMENT SERVICES PROGRAM

PG&E STUDY ID NUMBERS 336 & 337

PURPOSE OF STUDY

This evaluation was conducted in compliance with the requirements specified in "Protocols and Procedures for the Verification of Costs, Benefits, and Shareholders Earnings from Demand-Side Management Programs" ("Protocols"), as adopted by California Public Utilities Commission Decision 93-05-063, revised January, 1997, pursuant to Decisions 94-05-063, 94-10-059, 94-12-021, 95-12-054, and 96-12-079.

These studies evaluated the energy savings attributable to PG&E's 1995 Direct Assistance Program and Residential Energy Management Services Program.

METHODOLOGY

Savings from the Direct Assistance and Residential Energy Management Services Programs, were evaluated primarily through billling analysis. A telephone surve employing a sample of program participants and non-participants was conducted as part of the evaluation, to supplement the analysis of the Residential Energy Management Services Program. The analysis methods were designed to comply with procedures specified in Tables C-10, C-11 and other applicable portions of the Protocols.

STUDY RESULTS

The results of the analyses are summarized in the table below.

SUMMARY OF IMPACTS

	Reported Accomplishments*				Evaluation				Realization Rates		
Program	Number of Units	MW	MWh	Therms (1,000)	Number of Units	MW	MWh	Therms (1,000)	MW	MWh	Therms
Direct Assistance	44,328	2.706	16,795	907.4	44,328	2.08	13,070	692	0.768	0.778	0.763
Energy Management Services	160,008	3.503	19,366	1723.5	168,295	1.42	11,501	793	0.405	0.594	0.460

*Reported 1995 accomplishments are taken fro *Annual Summary Report on Demand Side Management Programs in 1995 and 1996* Pacific Gas and Electric Company (Revised December 1996).

REGULATORY WAIVERS AND FILING VARIANCES

Table 7 documents related to databases used in these evaluations will be filed on March 10, 1997, as approved by Joshua Faulk of ECONorthwest (February 19, 1997). There are no other waivers or filing variances associated with this evaluation.

1995 RESIDENTIAL DIRECT ASSISTANCE AND RESIDENTIAL ENERGY MANAGEMENT SERVICES IMPACT EVALUATION

Final Report

Prepared for

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February 28, 1997

LIST OF TABLES

1 INTRODUCTION

This report presents the results of impact evaluations of several of Pacific Gas and Electric Company's (PG&E's) 1995 Residential Demand-Side Management Programs.

The programs evaluated are as follows:

Direct Assistance Program (DA)

Energy Management Services (EMS)

1995 Energy Savings Plan (Single-Family Energy Management Services)

1995 Multi-Family Energy Management Services

1.1 PROGRAM DESCRIPTIONS

A brief description of each program evaluated is given below.

1.1.1 Direct Assistance Program (DA)

The Direct Assistance Program has two components, Energy Partners (EP) and the Target Customer Appliance Program (TCAP). The EP component provides energy education and weatherization. Weatherization measures include mandatory "Big Six" measures, as well as nonmandatory measures. The Big Six measures are

1. attic insulation
2. caulking
3. weatherstripping
4. water heater wrap
5. low-flow showerheads
6. minor home repair

The TCAP program provides replacement refrigerators, replacement evaporative coolers, compact fluorescent lights, and spare refrigerator removal.

1.1.2 Energy Management Services

The EMS programs provide recommendations for efficiency measures based on a walk-through audit or customer mail survey.

1995 Energy Savings Plan (Single-Family Energy Management Services)

The single-family EMS program had two components, onsite and mail.

1995 Multi-Family Energy Management Services

The multi-family EMS program provided audits of common areas of multi-family properties with five or more units.

1.2 SUMMARY OF EVALUATION METHODS

The evaluation approach varied according to the type of program evaluated. For each program, billing analysis was the primary basis of the evaluation. This analysis was designed to give net savings directly, without requiring separate net-to-gross adjustments. For the Single-Family EMS program, however, an explicit estimate of measure adoption rates attributable to the program was also developed to provide further insight into the billing analysis results.

The model structure and comparison group construction for the billing analysis varied across the programs. The modeling approaches are described in Section 2.

For the DA program and the multifamily EMS program, the only supplemental data incorporated into the billing analysis were customer data collected by the program, and weather data. For the single-family EMS program, an evaluation survey was conducted with participant and nonparticipant samples. The same survey instrument was used for participants and for nonparticipants, with supplemental program-related questions asked for participants. A copy of the survey instrument is included in Appendix A.

The survey served several purposes:

- It identified measures implemented by participants as well as nonparticipants, and the timing of these measure installations.
- It provided information used to estimate free ridership.
- It provided information on changes taking place in customer households, to account for some components of variation in the billing analysis.

1.3 SUMMARY OF RESULTS

The savings from the programs evaluated are summarized in Table 1-1. As the table indicates, the DA Program accounted for savings of 13.1 GWh, 2.1 MW, and 0.7 million therms. The EMS Program was responsible for savings of 11.5 GWh, 1.4 MW, and 0.8 million therms.

Table 1-1
Summary of Impacts

	Reported Accomplishments*				Evaluation				Realization Rates		
Program	Number of Units	MW	MWh	Therms (1,000)	Number of Units	MW	MWh	Therms (1,000)	MW	MWh	Therms
Direct Assistance	44,328	2.706	16,795	907.4	44,328	2.08	13,070	692	0.768	0.778	0.763
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*Reported 1995 accomplishments are taken fro *Annual Summary Report on Demand Side Management Programs in 1995 and 1996* Pacific Gas and Electric Company (Revised December 1996).

1.4 ORGANIZATION OF REPORT

A more complete discussion of the evaluation methods is provided in Section 2. The evaluation of each program is then presented separately in Sections 3 (DA Program) and Section 4 (EMS Program). Each program section describes the program, the specifics of the analysis methods used, and the findings. The survey instrument used for the Single-Family EMS Program is included in Appendix A. Summary tables conforming to the requirements of Table 6 of the CADMAC M&E Protocols are contained in Appendix B.

2 METHODOLOGY

2.1 OVERVIEW OF METHODS BY PROGRAM

This section presents a discussion of the evaluation methods used in the analysis of the Direct Assistance and Energy Management Services programs. To avoid repetition, common methods used for both programs are described in this section. Specifics of the application of these methods are given in each program section. As noted in Section 1, the primary evaluation method was billing analysis.

2.2 BILLING ANALYSIS

2.2.1 Data Sources

The following data sources were used for each of the billing analyses.

Program Tracking Data

The tracking data included the customer control number, type of measure installed, and installation or program participation date. Additional measure or customer information was available for some programs. For some of the programs, the program estimate of gross savings was also included.

Billing Records

Billing records were matched to participants by control number. The records for each customer included the beginning and ending of each meter reading period, number of days in the period, and amount consumed. The billing data used covered the period from January 1993 through October 1996.

Weather Data

Each customer was assigned to one of PG&E's 25 weather stations. The weather station assignment is based on the PG&E local which is identified in part of the customer's account number. Data taken from these weather stations were the daily temperatures for each day included in the billing analysis. In addition, we used the long-run average degree-days for each weather station, computed for the 12 year period from 1984 through 1995.

Customer Survey Data

Both the Direct Assistance program and the Multi-Family EMS program collected customer survey data as part of program implementation. This survey information was utilized in the analysis. In addition, a telephone survey was conducted on a sample of program participants and

nonparticipants as part of the evaluation. Results of the survey were used in the analysis of the single-family EMS program.

2.2.2 Billing Analysis Approach for Programs for Individual Residential Customers [Direct Assistance Program and Single-Family EMS Program]

The billing analysis approach for the Direct Assistance Program and the onsite and mail Single-Family EMS Program was a pooled time-series/cross-sectional (TSXS) analysis to determine net savings. That is, observations from all customers and all time periods in the analysis were combined into a single regression model. This regression was designed to estimate the net effect on consumption of implementing the program measure.

General TSXS model

The general form of the regression model fit is

$$
\begin{aligned}
Y_{jt} = {} & \mu_j + \tau_t \\
& + \beta_{HT}\, HDD63_{jt} + \beta_{AC}\, CDD72_{jt} \\
& + \delta_{HT}\, HDD63_{jt} * P_j + \delta_{AC}\, CDD72_{jt} * P_j \\
& + \Sigma_k\, \beta_k D_{kjt} \\
& + \gamma_0 PST_{jt} + \gamma_{HT}\, HDD63_{jt} * PST_{jt} + \gamma_{AC}\, CDD72_{jt} * PST_{jt} + \varepsilon_{jt}
\end{aligned}
$$

where

Y_{it}	= consumption per day for customer *j* during time period *t*
HDD63	= Heating degree-days per day base 63°F for customer *j*'s time period *t*
CDD72	= Cooling degree-days per day base 72°F for customer *j*'s time period *t*
P_j	= 0/1 cross-sectional dummy variable indicating that customer *j* is a program participant
PST_{jt}	= 0/1 dummy variable indicating that customer *j* implemented the program measure prior to time period *t*
D_{kjt}	= 0/1 dummy variable indicating that customer *j* implemented change *k* prior to time period *t*
ε_{jt}	= residual error

In the pooled model, the terms μ_i are customer-specific intercepts. The terms τ_t are time trends. The coefficients β, δ, and γ are estimated by the regression. The dummy variables for participation PST_{jt} are zero for time periods *t* prior to customer *j*'s participation, and 1 thereafter. Similarly, the dummy variables D_{kjt} are zero prior to the change and 1 thereafter.

The inclusion of the customer-specific and month-specific terms μ_j and τ_t is a first-order correction for the fact that observations for the same customer at different times or for the same

time across customers are not all independent. Rather, some of the unexplained factors that make up the residuals, ε_{jt} will be similar across time periods t for a given customer j, and across customers j for a given time period. Excluding the customer- and time-specific effects would treat the model as if there were many more independent observations than there really are, with the result that the precision of the estimates would be exaggerated.

Some evaluation practitioners fit the pooled time series cross sectional models using participants only. The reasoning is that the exogenous changes are captured by those who have not yet participated in a given month. The limitation of this approach is that virtually all participants in a given year are "nonparticipants" during the first few months, and all are participants in the later months. As a result, any general (nonprogram) trends that made consumption different in the early months from that in the later months would be confounded with the participation effect. For this reason, a comparison group is included in the models for each program.

For both programs, the effect of the measures is expected to be temperature-related. To account for this relationship, the measure dummy variable *PST* is interacted with degree-days, to estimate the savings per degree-day. The dummy variable is also included not interacted with degree-days. The separate savings terms are not necessarily all significant. However, including the multiple terms allows adjustment in the model for possible misspecification of the weather dependence, thus reducing possible biases in the combined estimate of the effect.

The index *t* indicates the month and year of the end date of the meter reading period. The dates used for the degree-day calculation are the reading dates specific to each customer. For example, for a customer *j* assigned to weather station 22 for a meter reading period *t* with begin date June 10, 1994 and end date July 8, 1994, cooling degree-days CDD_{jt} are computed using the daily temperatures from that weather station and that range of dates.

Separate degree-day coefficients are allowed for nonparticipants than for participants, to account for the fact that the two groups may have been different in this respect even prior to participation. The different coefficients are estimated by interacting the degree-day variables with the cross-sectional participation dummy. Similarly, separate degree-day coefficients were allowed for participant subgroups $P_{j.}$

To estimate annual savings, the average annual value of each of the terms interacted with the post-participation dummy variable is determined, and multiplied by the corresponding coefficient. Total annual savings is estimated by the sum of these effects. The degree-day terms interacted with the post-participation dummy variables are calculated using long-run normal weather conditions. The average is computed across all customers in the tracking system. For the Single-Family EMS program however, the average was computed across all surveyed participants. This approach satisfies the weather adjustment requirements of the Protocols (Tables C-10 and C-11).

For each of the programs there were some variations on this general modeling approach. The specifics of each program's model are described in the section on that program.

Interpretation as net savings

The nonparticipants included in the model control for changes over time due to factors unrelated to the program. For the EMS program, the inclusion of the nonparticipants also controls for installation of measures outside the program, allowing the savings estimated to be interpreted as net savings. Because the estimates are based on changes in customers' bills, they also incorporate snapback effects, short-term measure persistence, and participant spillover effects, without requiring separate adjustment for these factors.

Comparison of Evaluation Results with PG&E Estimates

Tables in Section 1 and Appendix B compare evaluation results with PG&E program-level savings reported in the *Annual Summary Report on Demand Side Management Programs*. Realization rates reported by program component in Sections 3 and 4 compare evaluation results with PG&E planning documents.

3 RESIDENTIAL DIRECT ASSISTANCE

3.1 PROGRAM DESCRIPTION

The DA Program is described as follows in PG&E's *Annual Summary Report on Demand Side Management Programs in 1995 and 1996* (Revised December 1996).

> The Direct Assistance (DA) Program has four components: Energy Partners (EP) providing weatherization and energy education services, and a Target Customer Appliance Program (TCAP) providing energy efficient refrigerators to qualified low income customers, pilot programs, and Gas Furnace Repair[/Replacement].
>
> The Direct Assistance Program helps low income customers reduce their energy consumption and costs by providing free weatherization and energy efficient refrigerator replacement services. The program also addresses energy related hardship reductions for low income customers (i.e., energy reductions lead to lower utility bills, improving the customer's ability to pay the bills).
>
> The Energy Partners component provided free weatherization and energy education to low income customers throughout PG&E's service territory. These services included the mandatory "Big Six" measures, and nonmandatory measures designed to reduce customer energy consumption and improve the energy efficiency of the structure. Also included in the nonmandatory category is a minor home repair component that replaces broken windows, and doors to increase the effectiveness of the weatherization services. Energy education is provided to customers to help them understand how they use energy and provide them with specific strategies to reduce their energy costs.
>
> The TCAP program provides free energy efficient refrigerators to low income customers to help them reduce their energy costs. Two sizes are offered to customers, based on family size: a 14 cubic foot and a 18 cubic foot. This service includes delivery, installation and the "environmentally safe" appliance removal and recycling of the inefficient units replaced.

Pilot Programs

In 1995, PG&E conducted two separate pilot programs to test program enhancement concepts which could be incorporated into future Direct Assistance Programs. A total of 1,832 units were completed through these two pilot programs.

Venture Partners Pilot

In 1995 PG&E conducted a joint pilot program with the Department of Economic Opportunity (DEO) to test the concept of integrating the program services of Energy Partners with those of the State DEO weatherization program. The intent of this pilot was to evaluate and determine whether opportunities existed allowing both PG&E and DEO to leverage weatherization and energy education services to low income customers through a linked program process.

The original pilot program was projected to accomplish 2,000 units. However, due to training and pilot implementation delays, actual unit accomplishment was 715 units.

Initial pilot findings showed that combining PG&E's Energy Partners Program with the State DEO's weatherization program is feasible. However, issues surfaced concerning dissimilar inspection standards, billing and invoicing processes requiring further modification of program policies if a full program was to be implemented in the future. Integrating weatherization/energy education services of PG&E and DEO produced a significant savings during the pilot to both programs, and increased services to low income customers, without increasing program expenditures.

Integrated Services Pilot

The second pilot program PG&E conducted in 1995 was the Integrated Services Pilot program. The purpose of this pilot was to:

- Determine whether an enhanced energy education process, including two education visits, significantly helped customers reduce energy usage in comparison to the single interaction education process currently used in the Energy Partners Program.
- Determine if "de-coupling" or removing the energy education process from the weatherization process produced a higher quality education visit.
- Determine if energy education could have impacts on non-energy areas such as late payment and arrearages.
- Evaluate different program marketing options such as telemarketing and direct mail to determine if they are less expensive, more effective options to neighborhood canvassing.

Initially 2,000 units were targeted for completion in the Integrated Services Pilot Program. However, due to start-up delays, actual unit production was 1,117 units.

Initial pilot findings demonstrated energy education could be removed from the weatherization process without affecting subcontractor weatherization production. Customers will accept a two-step energy education. Whether energy education assists the customer with payment issues or in reducing energy consumption was hard to separate from weatherization impacts. Customers did feel they had a better understanding of how they used energy in their homes and had more control over their energy costs.

Marketing results showed that a direct mail strategy, with a supporting 800 number center, will work well as an alternative to neighborhood canvassing.

PG&E is currently evaluating pilot findings to determine whether findings can be incorporated into future Direct Assistance Program offerings.

Implementation Strategy

In 1995, to reduce administration costs and improve services to low income customers, PG&E continued to combine the Energy Partners and TCAP programs into a single program.

Target Market

Low income customers residing in income targeted areas where 60 percent of the residents are at 80 percent or below the median area income. TCAP income qualifications are based on the California Alternative Rate for Energy (CARE) (formerly Low Income Rate Assistance, or LIRA) income guidelines. The customers must have a refrigerator that is 10 years old or older in order to participate in the refrigerator component.

1995 PROGRAM ACCOMPLISHMENTS

	Goal	Accomplished
Direct Asst. units served	42,000	44,328
Direct Asst. units weatherized	42,000	41,837
CFLs installed	77,010	51,434
Primary refrigerator replaced	10,000	10,000
2nd refrigerator removed	750	158
Venture Partners Pilot units	2,000	715
Integrated Service Pilot	2,000	1,117

Note: Units accomplished in the Venture Partners and Integrated Services Pilots are included in total Direct Assistance units weatherized.

. . .

Net Energy Impacts (First Year)

kW	2,706
kWh	16,794,539
therms	907,448

3.2 SUMMARY OF RESULTS

Table 3-1 summarizes the savings estimated by the evaluation.

Table 3-1
Summary of Net Impact Estimates
Direct Assistance Program

	Evaluation Results					Program Planning			Realization
Electricity	Customers	Total MWh	SE(Total MWh)	Total MW	SE(Total MW)	Customers	Total MWh	Total MW	Rate
Weatherization, Education & Lighting	41,837	4,64	446	1.02	0.10	41,837	9,47	1.36	0.49
Total Refrigerators	10,000	8,42	204	1.06	0.03	10,000	7,29	1.31	1.15
Total Program	44,328	13,070	447	2.08	0.07	44,328	16,769	2.67	0.77

	Evaluation Results			Program Planning		
Gas	Customers	Total Therms (1,000)	SE(Total Therms) (1,000)	Customers	Total Therms (1,000)	Realization Rate
Total Program	41,837	692	47	41,837	907	0.76

The table shows that the net savings estimated by the evaluation for weatherization and lighting measures combined are lower than the program planning estimates. The refrigerator savings are somewhat larger than those projected by the program. In total, the program net energy savings were 77.9 percent of the projected level for electricity, and 76.3 percent for gas. The program planning numbers fall outside the 90 percent confidence bands for these estimates.

The methods used to develop the evaluation estimates and more detailed results are presented below.

3.3 METHODOLOGY

As described in Section 2, the basis for the impact estimates was a billing analysis to determine net savings.

3.3.1 Billing Analysis

The general form of the billing analysis regression model is described in Section 2. This model is a pooled time series cross-sectional model, which combines into a single model all time periods from all customers included in the analysis. The regression model incorporates information from the customer surveys collected by the program as well as billing and weather data. No additional surveys were conducted for this program as part of this evaluation.

Separate load impact models were estimated for each of three housing types, for electricity and gas. The electric models included separate terms for air conditioned and non-air conditioned units. For each house type and air conditioning group, the effects of weatherization/education measures and lighting are jointly estimated. The effects of refrigerator replacement are separately estimated.

Comparison Group Specification

The model includes participants from program year 1995 as well as participants from program years 1994 and 1996. The impact analysis is for program year 1995. Participants from other years are included as a comparison group. The inclusion of these customers in the model means that each month's observations will include some customers who have already participated and some who have not yet. This approach extends to the pooled monthly model the idea of using previously served customers and those in the "pipeline" for a program as a comparison group for current participants. This type of comparison group has often been used for impact evaluations of low-income programs, because of the difficulty of otherwise finding comparable nonparticipants. The participants from other years are expected to be similar to the 1995 participants in terms of household composition, income level, and other factors that might affect changes in energy consumption. Including them in the model controls for changes over time that are not related to the program.

Model Specification

The effect of program participation is estimated separately for 1995 participants and those from other program years (non95). It is necessary to include terms in the model to control for the effect of participating in the program in the other years. However, the savings of interest from this analysis is the program effect specifically for 1995 participants.

The terms included in the regression models are

- Customer-specific dummy variables (included implicitly, but not explicitly estimated by the model)
- Time-period dummy variables for each month in the analysis

- Heating degree-days, base 63^{o}F (separate coefficients for 1995 and non95 participants, and separate for customers with and without air conditioning in the electric model)
- Cooling degree-days, base 72^{o}F (electric model only, separate coefficients for 1995 and non95 participants, with and without air conditioning)
- Time series program participation dummy variable, by itself and interacted with degree-days (separate coefficients for 1995 and non95 participants, and separate for customers with and without air conditioning in the electric model)
- Time series refrigerator participation dummy variable (separate coefficients for 1995 and non95 participants).

All participants in the tracking system from all three program years who met screening criteria were included in the billing analysis. The screening criteria included:

- No multiple records for a given control number.
- Fuel code information not missing.
- House type information not missing
- Survey information not missing.
- Billing information not missing.

3.3.2 Participation Counts

Both program planning estimates and evaluation estimates are developed on a per-unit basis. To make sense of these unit estimates, it is necessary to know how a unit is defined. To compare the estimates, it is necessary to put them on a common basis.

Program Planning Estimates

For weatherization, the units used for the program planning estimates are households served by the program. Household counts are separated by type and air conditioning presence: single family, multifamily or mobile home, each with and without air conditioning. Lighting measures are counted by the number of light bulbs installed. However, the tracking data do not record the number of bulbs installed in each home, only whether or not any were installed. Refrigerators are counted by the number of refrigerators replaced (and in a few cases, removed). The program also counts the number of unique customers served by either weatherization (including lighting measures) or refrigerators (or both).

Evaluation Estimates

The evaluation estimates are developed from billing analyses for electricity and for gas. The resulting estimates are per participant with the particular fuel type. Separate estimates are developed for each of the house type (and air conditioning) groups. Total program savings are

determined by multiplying the unit estimates by the number of customers in each group with the given fuel type.

For a fraction of the customers in the tracking data sets, the house type and air conditioner presence were not identified. Thus, the evaluation could not directly determine the total number of households in each analysis group. However, we can count in the tracking data the total number of unique weatherization participants, the total number of refrigerators delivered, and the total number of unique customers who received either weatherization or a refrigerator. These counts closely match those reported by the program.

We therefore use the program's reported count by customer group to calculate the total savings in each group. The program's counts were based on tallying the summary counts reported by the implementation contractors. Since these counts were close to the actual tracking records found, the component counts by subgroup should be reliable.

It was not possible to determine the exact overlap between households receiving refrigerators and those receiving weatherization services. The primary basis for matching customer records was by control number. For some multifamily customers with master-metered accounts, a single control number corresponds to several households. Each household served appears as a separate record in the weatherization data base. However, there is no unique identifier to match weatherized households with those receiving refrigerators. For this reason, the evaluation relies on the program's report of the total unique households served.

The program counts are the number of households served. The regression results provide net energy savings per household with a given fuel type. Thus, to expand the regression results to program-level totals for each subgroup, we had to estimate the number of customers with each fuel type. This information was not available from the tracking data. We estimated the number of customers with each fuel in each subgroup. We did so by determining the fraction or households with gas service and the fraction with electric service, as fractions of the total number for which we had either type of bill. These fractions were 0.837 for electricity and 0.844 for gas. We applied these fractions to each subgroup's program count.

Comparison of Program and Evaluation Counts

Table 3-2 summarizes the program-reported counts and those used for the evaluation.

Table 3-2
Program and Evaluation Counts

	DSM Summary Report	Tracking Data*	Evaluation			Notes on Evaluation Count
			Total	Electric	Gas	
Units Weatherized	41,837	42,083	41,837	35,022	35,320	41,065 records with at least one positive measure installation flag
Refrigerators Replaced	10,000	10,656	10,000	10,000		Excludes 656 records with (VOID=1), (REVISION>0), or (BRANDNEW=missing or =REFUSED DELIVERY)
CFLs installed	51,434	NA	NA			tracking data indicate households w/CFL's but not # CFL's for each household
Unique Households Served	44,328	NA	44,328	37,513	35,320	can't determine weatherization/refrigerator overlap by household

*Records for 715 Venture Pilot Program participants were not available in time for the evaluation, and are not included.

3.3.3 Discussion of Modeling Issues and Approaches

Limitations of the Models

- Lighting effects could not be isolated because of the near complete confounding between lighting measures and weatherization.
- Separate effects of Big-6 weatherization measures could not be isolated because nearly all participants had basic weatherization measures.
- Separate effects of non-Big-6 weatherization and repair measures could not be isolated because such actions occurred only in conjunction with other measures.
- Households that received only refrigerators and no weatherization were nearly all excluded from the analysis, because the models required air conditioning information, which was available only for units that were surveyed as part of the weatherization/energy education component of the program.
- In aggregate, the savings results are reasonable, but the individual coefficients are not always meaningful. Some savings terms have nonsignificant coefficients, or coefficients of the wrong sign. This was the result of using consistent model formulations for different participation groups. The model formulations are designed to reduce the potential for biases, at the expense of some increase in the variance of the overall estimate.

Data Issues

Program information had to be merged together from several different sources. For each program year, we had the following data sets:

- Survey data
- Weatherization/Lighting Measures (Big-6 and non-Big-6)
- Refrigerators
- Fuels/end uses and house type
- Billing data (January 1993 through October 1996).

These data sets had to be merged together. Some customers could be found in some data sets but not all. (Refrigerator customers were not necessarily expected to be found in the Survey, Measures, and Fuel/End Uses files.)

The Measures data base indicated for each participant which measures had been implemented, but not the number of units installed. In addition, approximately 2/3 of the customers in the Measures data had no installation date indicated. For these customers, we assumed that the installation occurred sometime between the survey date and the end of the program year.

The Fuels and House Type data base included only about half the participants. This information was required to classify customers by air conditioning presence. The house type information was also needed to classify customers for the separate regressions by house type. However, the house types coded in the billing records were used for customers missing this information in the tracking system. The tracking variable had more definition, and was assumed to be more reliable when present.

For some control numbers there were multiple records in a single data base. We assumed that these cases were master metered accounts, or errors. These cases were excluded from the billing analysis.

3.3.4 Other Efforts Attempted

- Isolate effects of individual measures, including weatherization, water heating, and lighting. The resulting estimates were unreasonable in magnitude, not statistically significant, and/or very inconsistent across separately estimated subgroups. For this reason, we feel that we can estimate the total program effect, including lighting, but cannot reliably decompose that effect by measure group.
- Refine estimates by incorporating survey information on fuels used for end uses. These regressions did not substantially change the overall estimates of program savings. For gas customers, the great majority had both gas space heat and gas water heat, so that the regression estimates changed only moderately when interacted with fuel type. In addition, the group of customers flagged as non gas (or electric) heating still had a strong relationship to

degree-days in both the gas and electric regressions. These patterns may reflect errors in the fuel codes, secondary heating with gas (via ovens) and electricity, and nonheating seasonality of use for both fuels.

- Fit electricity models excluding all refrigerator participants. The fit was intended to identify the weatherization and lighting effects without confounding with the dominating refrigerator effect. The result showed little change in the combined weatherization and lighting effect.
- Fit electricity models for participants who received only refrigerators and no other program measures. The fits were intended to identify the refrigerator effects without confounding with the weatherization and lighting effects The results showed little change in the estimated refrigerator effects. The refrigerator estimates were in fact very stable across a variety of models fit.

3.4 RESULTS

3.4.1 Net Savings from Billing Analysis

Table 3-3 lists the variables used in the regression models. The attrition analysis, indicating which customers were included in the regressions, is summarized in Table 3-4. Results of the regressions are shown in Table 3-5.

Table 3-3
Variables Included in the Pooled Regression Models
Direct Assistance Program

Variable	Description
Month-Year	Indicator variables for each month-year combination
February-93	Indicator variable for February 1993
.	.
.	.
.	.
October-96	Indicator variable for October 1996
HDD63A	Heating degree days
CDD72	Cooling degree days
REF_P	Time Series dummy for 1994/96 Refrigerator participant
PART_S	Time Series dummy for 1994/96 weatherization survey participation
REF_P95	Times Series dummy for 1995 Refrigerator participant
PART_S95	Time Series dummy for 1995 weatherization survey participation
'95'	Cross-sectional dummy for 1995 participant
'Non95'	Cross-sectional dummy for 1994/96 participant
AC	Cross-sectional dummy for electric AC

Table 3-4
Attrition Analysis
Direct Assistance Program

A. Customer Attrition (by control number

	1995	1994/96	Total
INITIAL BASE			
(1) In weatherization survey data base - unique control numbers	37,207	65,810	103,017
(2) In refrigerator data base	10,000	10,844	20,844
(3) Total unique control numbers in weatherization or refrigerator data base	41,567	69,362	110,929
PROGRAM RECORDS SCREENS			
(4) = (3) Less weatherization survey customers not found in weatherization measures file	36,873	44,685	81,558
(5) = (4) Less customers not found in fuel/house type file	26,093	40,001	66,094
BILLING RECORD SCREEN			
(6) = (3) Less control numbers with adequate billing history	16,130	53,080	69,210
FINAL DATA SET (JOIN OF BILLING AND PROGRAM SCREENS)			
(7) = Merge of (5) and (6)	16,130	11,971	28,101

Table 3-4 (Continued)

B. Electric and Gas Analysis Data Sets

		1995		1994/96		Total	
		Number of Customers	Number of Observations*	Number of Customers	Number of Observations*	Number of Customers	Number of Observations*
	ELECTRIC						
(6)	Unique control numbers with adequate billing history	15,729	668,929	42,207	1,531,269	57,936	2,200,198
(7)	Final analysis data set	15,729	668,929	7,756	153,459	23,485	822,388
	GAS						
(6)	Unique control numbers with adequate billing history	15,899	676,652	42,530	1,547,178	58,429	2,223,830
(7)	Final analysis data set	15,899	676,652	8,204	168,358	24,103	845,010

*Customer-month observations in pooled TSXS regression.

Table 3-5A
Net Load Impact Regression Model
Direct Assistance Program (Electric Single Family)

Parameter	Estimate	t-statistic	SE
February-93	-0.3601	-3.46	0.1041
March-93	-0.5868	-5.48	0.1070
April-93	-0.6833	-5.86	0.1167
May-93	-0.7917	-6.44	0.1229
June-93	-0.4236	-3.33	0.1271
July-93	-0.0145	-0.11	0.1304
August-93	0.0336	0.26	0.1304
September-9	-0.0903	-0.7	0.1297
October-93	-0.0338	-0.26	0.1277
November-93	0.0716	0.59	0.1218
December-93	-0.1632	-1.63	0.1003
January-94	-0.1610	-1.64	0.0983
February-94	-0.6719	-6.66	0.1009
March-94	-0.6365	-6.05	0.1053
April-94	-0.8127	-7.13	0.1140
May-94	-0.6882	-5.82	0.1182
June-94	-0.4535	-3.64	0.1247
July-94	-0.0926	-0.72	0.1294
August-94	0.0224	0.17	0.1296
September-9	-0.0367	-0.28	0.1310
October-94	-0.0015	-0.01	0.1300
November-94	-0.0865	-0.73	0.1182
December-94	-0.0846	-0.79	0.1067
January-95	0.4635	4.34	0.1069
February-95	0.2419	2.22	0.1087
March-95	-0.3129	-2.88	0.1087
April-95	-0.6802	-6.07	0.1120
May-95	-0.6069	-5.2	0.1166
June-95	-0.5495	-4.44	0.1237
July-95	-0.2799	-2.16	0.1297
August-95	0.0946	0.72	0.1308
September-9	-0.0520	-0.39	0.1317
October-95	-0.0584	-0.45	0.1306
November-95	0.0416	0.33	0.1275
December-95	0.4115	3.44	0.1196
January-96	0.3419	3.01	0.1135
February-96	0.2272	2.02	0.1127
March-96	-0.0396	-0.35	0.1135
April-96	-0.5180	-4.44	0.1167
May-96	-0.5261	-4.32	0.1218
June-96	-0.2119	-1.68	0.1262
July-96	0.1556	1.22	0.1280
August-96	0.4856	3.72	0.1306
September-9	0.2137	1.64	0.1304
October-96	0.0003	0	0.1278
HDD63A Non9	0.2396	43.16	0.0056
HDD63A 95	0.2378	40.88	0.0058
CDD72A Non95 NonAC	0.6403	34.58	0.0185
CDD72A Non95 AC	0.9054	125.67	0.0072
CDD72A 95 NonAC	0.6313	33.66	0.0188
CDD72A 95 AC	0.8363	93.39	0.0090
REF_P Non95	-2.4538	-43.63	0.0562
HDD63A*PART_S Non9	-0.0180	-2.82	0.0064
CDD72A*PART_S Non95 NonAC	-0.0367	-1.58	0.0233
CDD72A*PART_S Non95 AC	-0.0181	-1.87	0.0097
PART_S Non95 NonAC	-0.1046	-1.86	0.0564
PART_S Non95 AC	-0.2032	-3.41	0.0596
REF_P 95	-2.3431	-35.83	0.0654
HDD63A*PART_S 95	-0.0169	-1.89	0.0089
CDD72A*PART_S 95 NonAC	0.0296	1.22	0.0243
CDD72A*PART_S 95 AC	-0.0071	-0.55	0.0128
PART_S 95 NonAC	-0.3221	-5.18	0.0622
PART_S 95 AC	-0.2558	-3.36	0.0762

Dependen	
Variable	kWh/da
Number of	
Observations:	387,94
Number of	
Customers:	10,610
R-Square:	0.763

Table 3-5B
Net Load Impact Regression Model
Direct Assistance Program (Electric Multifamily)

Parameter	Estimate	t-statistic	SE
February-93	-0.3394	-3.66	0.0926
March-93	-0.8008	-8.38	0.0955
April-93	-1.2213	-11.9	0.1027
May-93	-1.4576	-13.59	0.1072
June-93	-1.4169	-12.75	0.1111
July-93	-1.5397	-13.65	0.1128
August-93	-1.4806	-13.11	0.1129
September-93	-1.3329	-11.86	0.1124
October-93	-1.0560	-9.52	0.1109
November-93	-0.8254	-7.73	0.1068
December-93	-0.3015	-3.36	0.0897
January-94	0.0167	0.19	0.0876
February-94	-0.4687	-5.25	0.0893
March-94	-0.8963	-9.62	0.0932
April-94	-1.2798	-12.89	0.0993
May-94	-1.3492	-13.18	0.1023
June-94	-1.4054	-13.06	0.1076
July-94	-1.2801	-11.62	0.1102
August-94	-1.1822	-10.66	0.1109
September-94	-1.1902	-10.63	0.1119
October-94	-0.9354	-8.41	0.1112
November-94	-0.7270	-7.25	0.1003
December-94	0.0142	0.16	0.0900
January-95	0.2731	3.03	0.0901
February-95	-0.2477	-2.65	0.0936
March-95	-0.6532	-6.92	0.0944
April-95	-0.9755	-10.09	0.0967
May-95	-1.1073	-11.03	0.1004
June-95	-1.2175	-11.49	0.1060
July-95	-1.3110	-11.8	0.1111
August-95	-1.1331	-10.11	0.1121
September-95	-1.0239	-9.02	0.1136
October-95	-0.7840	-6.93	0.1131
November-95	-0.5938	-5.31	0.1119
December-95	-0.2306	-2.18	0.1058
January-96	-0.0131	-0.13	0.0998
February-96	-0.0738	-0.75	0.0984
March-96	-0.4104	-4.15	0.0988
April-96	-0.9058	-8.94	0.1013
May-96	-1.0277	-9.77	0.1052
June-96	-1.0896	-10.05	0.1085
July-96	-1.0571	-9.68	0.1092
August-96	-0.7299	-6.57	0.1111
September-96	-0.7654	-6.86	0.1116
October-96	-0.7199	-6.54	0.1100
HDD63A Non95	0.1095	21.15	0.0052
HDD63A 95	0.1071	22.59	0.0047
CDD72A Non95 NonAC	0.6185	26.98	0.0229
CDD72A Non95 AC	0.8893	124.63	0.0071
CDD72A 95 NonAC	0.6541	42.26	0.0155
CDD72A 95 AC	0.8277	133.83	0.0062
REF_P Non95	-2.0059	-40.09	0.0500
HDD63A*PART_S Non95	0.0210	3.45	0.0061
CDD72A*PART_S Non95 NonAC	0.2110	7.05	0.0299
CDD72A*PART_S Non95 AC	0.0043	0.46	0.0095
PART_S Non95 NonAC	-0.4664	-9.95	0.0469
PART_S Non95 AC	-0.4860	-7.84	0.0620
REF_P 95	-1.9537	-42.3	0.0462
HDD63A*PART_S 95	0.0002	0.04	0.0067
CDD72A*PART_S 95 NonAC	-0.0236	-1.18	0.0200
CDD72A*PART_S 95 AC	0.0325	3.83	0.0085
PART_S 95 NonAC	-0.1805	-4.03	0.0448
PART_S 95 AC	-0.4817	-9.18	0.0525

Dependent Variable:	kWh/day
Number of Observations:	402,565
Number of Customers:	11,969
R-Square:	0.757

Table 3-5C
Net Load Impact Regression Model
Direct Assistance Program (Electric Mobile)

Parameter	Estimate	t-statistic	SE
February-93	0.8009	2.01	0.3976
March-93	0.4178	1.02	0.4100
April-93	0.3315	0.73	0.4544
May-93	0.4493	0.93	0.4808
June-93	0.6951	1.39	0.5015
July-93	0.3547	0.68	0.5210
August-93	0.8237	1.59	0.5193
September-93	0.7886	1.53	0.5139
October-93	0.9173	1.81	0.5068
November-93	1.1573	2.43	0.4759
December-93	0.4010	1.05	0.3831
January-94	0.4860	1.3	0.3743
February-94	0.3897	1.01	0.3849
March-94	0.4800	1.17	0.4088
April-94	0.1789	0.4	0.4449
May-94	0.4304	0.92	0.4667
June-94	0.6377	1.29	0.4948
July-94	0.5346	1.03	0.5194
August-94	0.7053	1.36	0.5203
September-94	0.9341	1.8	0.5198
October-94	0.7102	1.39	0.5098
November-94	0.4921	1.1	0.4455
December-94	0.4661	1.2	0.3892
January-95	0.8287	2.11	0.3924
February-95	0.8264	1.99	0.4151
March-95	0.3605	0.86	0.4187
April-95	0.1832	0.43	0.4300
May-95	0.3504	0.77	0.4550
June-95	0.7562	1.54	0.4917
July-95	1.3490	2.61	0.5173
August-95	1.5975	3.05	0.5233
September-95	1.4102	2.71	0.5209
October-95	1.2258	2.37	0.5179
November-95	0.9457	1.89	0.5016
December-95	1.0705	2.27	0.4721
January-96	0.3967	0.9	0.4405
February-96	0.8802	2.01	0.4379
March-96	0.7517	1.71	0.4391
April-96	0.4256	0.94	0.4537
May-96	0.5985	1.26	0.4736
June-96	1.2264	2.46	0.4977
July-96	1.6710	3.29	0.5077
August-96	1.9729	3.78	0.5223
September-96	1.4868	2.89	0.5138
October-96	1.0516	2.09	0.5031
HDD63A Non95	0.2579	11.89	0.0217
HDD63A 95	0.2595	12.72	0.0204
CDD72A Non95 NonAC	1.0016	11.06	0.0905
CDD72A Non95 AC	0.9941	32.36	0.0307
CDD72A 95 NonAC	0.7007	4.96	0.1412
CDD72A 95 AC	0.9677	33.86	0.0286
REF_P Non95	-3.3938	-17.27	0.1965
HDD63A*PART_S Non95	-0.0147	-0.61	0.0239
CDD72A*PART_S Non95 NonAC	-0.1398	-1.22	0.1144
CDD72A*PART_S Non95 AC	-0.2601	-6.78	0.0384
PART_S Non95 NonAC	-0.3703	-1.47	0.2520
PART_S Non95 AC	0.3320	1.47	0.2262
REF_P 95	-2.4165	-11.73	0.2061
HDD63A*PART_S 95	-0.0297	-1	0.0297
CDD72A*PART_S 95 NonAC	0.4080	2.17	0.1884
CDD72A*PART_S 95 AC	-0.1258	-3.25	0.0387
PART_S 95 NonAC	-0.3135	-1.05	0.2995
PART_S 95 AC	-0.3096	-1.39	0.2227

Dependent Variable:	kWh/day
Number of Observations:	31,876
Number of Customers:	906
R-Square:	0.756

Table 3-5D
Net Load Impact Regression Model
Direct Assistance Program (Gas Single Family)

Parameter	Estimate	t-statistic	SE
February-93	-0.1240	-10.91	0.0114
March-93	-0.3197	-26.78	0.0119
April-93	-0.5001	-37.95	0.0132
May-93	-0.5944	-42.60	0.0140
June-93	-0.6257	-43.22	0.0145
July-93	-0.7167	-48.81	0.0147
August-93	-0.7300	-49.67	0.0147
September-93	-0.7181	-48.95	0.0147
October-93	-0.6344	-43.64	0.0145
November-93	-0.4792	-34.91	0.0137
December-93	-0.3091	-28.12	0.0110
January-94	-0.1828	-17.13	0.0107
February-94	-0.2167	-19.72	0.0110
March-94	-0.3580	-30.46	0.0117
April-94	-0.5355	-41.49	0.0129
May-94	-0.5729	-42.69	0.0134
June-94	-0.6273	-44.16	0.0142
July-94	-0.6920	-47.31	0.0146
August-94	-0.6919	-47.25	0.0146
September-94	-0.6807	-45.71	0.0149
October-94	-0.6196	-41.76	0.0148
November-94	-0.4573	-34.25	0.0134
December-94	-0.3544	-29.84	0.0119
January-95	-0.1499	-12.86	0.0117
February-95	-0.1870	-15.38	0.0122
March-95	-0.3413	-27.97	0.0122
April-95	-0.4359	-34.55	0.0126
May-95	-0.5118	-38.57	0.0133
June-95	-0.5836	-41.41	0.0141
July-95	-0.6586	-44.97	0.0146
August-95	-0.6966	-47.54	0.0147
September-95	-0.6838	-46.01	0.0149
October-95	-0.6336	-42.74	0.0148
November-95	-0.4873	-33.66	0.0145
December-95	-0.4177	-31.21	0.0134
January-96	-0.3899	-30.91	0.0126
February-96	-0.2984	-23.74	0.0126
March-96	-0.3659	-28.81	0.0127
April-96	-0.5319	-40.36	0.0132
May-96	-0.5949	-42.94	0.0139
June-96	-0.6346	-44.21	0.0144
July-96	-0.6896	-47.74	0.0144
August-96	-0.6996	-48.13	0.0145
September-96	-0.6787	-46.13	0.0147
October-96	-0.6447	-44.39	0.0145
HDD63A Non95	0.1250	193.95	0.0006
HDD63A 95	0.1187	178.81	0.0007
PART_S	-0.0427	-8.36	0.0051
HDD63A*PART_S	0.0018	2.60	0.0007
PART_S95	0.0006	0.11	0.0059
HDD63A*PART_S95	-0.0082	-8.50	0.0010

Dependent Variable:	Therms/day
Number of Observations:	446,31
Number of Customers:	11,888
R-Square:	0.743

Table 3-5E
Net Load Impact Regression Model
Direct Assistance Program (Gas Multifamily)

Parameter	Estimate	t-statistic	SE
February-93	-0.0779	-6.46	0.0120
March-93	-0.1780	-14.23	0.0125
April-93	-0.2785	-20.62	0.0135
May-93	-0.3049	-21.55	0.0142
June-93	-0.3035	-20.67	0.0147
July-93	-0.3611	-24.35	0.0148
August-93	-0.3612	-24.30	0.0149
September-93	-0.3572	-24.10	0.0148
October-93	-0.3026	-20.63	0.0147
November-93	-0.2315	-16.47	0.0141
December-93	-0.2281	-19.50	0.0117
January-94	-0.1843	-16.19	0.0114
February-94	-0.1845	-15.86	0.0116
March-94	-0.2046	-16.77	0.0122
April-94	-0.2992	-22.87	0.0131
May-94	-0.3024	-22.37	0.0135
June-94	-0.2971	-20.86	0.0142
July-94	-0.3424	-23.51	0.0146
August-94	-0.3340	-22.84	0.0146
September-94	-0.3271	-22.14	0.0148
October-94	-0.2914	-19.85	0.0147
November-94	-0.2769	-20.99	0.0132
December-94	-0.3052	-26.07	0.0117
January-95	-0.1739	-14.89	0.0117
February-95	-0.1299	-10.59	0.0123
March-95	-0.2223	-17.95	0.0124
April-95	-0.2637	-20.77	0.0127
May-95	-0.2834	-21.38	0.0133
June-95	-0.2798	-19.96	0.0140
July-95	-0.2945	-20.13	0.0146
August-95	-0.3345	-22.79	0.0147
September-95	-0.3223	-21.53	0.0150
October-95	-0.2940	-19.70	0.0149
November-95	-0.2340	-15.83	0.0148
December-95	-0.2094	-15.05	0.0139
January-96	-0.2242	-17.16	0.0131
February-96	-0.1636	-12.68	0.0129
March-96	-0.1924	-14.83	0.0130
April-96	-0.2724	-20.41	0.0133
May-96	-0.2861	-20.59	0.0139
June-96	-0.3080	-21.48	0.0143
July-96	-0.3315	-23.04	0.0144
August-96	-0.3398	-23.40	0.0145
September-96	-0.3321	-22.56	0.0147
October-96	-0.3082	-21.20	0.0145
HDD63A Non95	0.1016	151.62	0.0007
HDD63A 95	0.0961	154.89	0.0006
PART_S	-0.0148	-2.88	0.0052
HDD63A*PART_S	-0.0040	-5.36	0.0007
PART_S95	0.0119	2.38	0.0050
HDD63A*PART_S95	-0.0136	-16.58	0.0008

Dependent Variable:	Therms/day
Number of Observations:	376,829
Number of Customers:	11,359
R-Square:	0.737

Table 3-5F
Net Load Impact Regression Model
Direct Assistance Program (Gas Mobile)

Parameter	Estimate	t-statistic	SE
February-93	0.0779	1.81	0.0431
March-93	-0.0209	-0.47	0.0448
April-93	-0.0987	-1.97	0.0500
May-93	-0.2085	-3.95	0.0528
June-93	-0.2342	-4.27	0.0549
July-93	-0.3447	-6.17	0.0559
August-93	-0.3680	-6.58	0.0559
September-93	-0.3598	-6.45	0.0557
October-93	-0.2575	-4.64	0.0555
November-93	-0.0713	-1.36	0.0524
December-93	-0.0855	-2.04	0.0419
January-94	-0.0509	-1.25	0.0407
February-94	0.0036	0.09	0.0418
March-94	-0.0766	-1.71	0.0447
April-94	-0.1561	-3.19	0.0489
May-94	-0.2059	-4.02	0.0512
June-94	-0.2628	-4.85	0.0542
July-94	-0.3396	-6.06	0.0560
August-94	-0.3396	-6.07	0.0560
September-94	-0.3384	-6.00	0.0564
October-94	-0.2405	-4.32	0.0557
November-94	-0.1110	-2.26	0.0491
December-94	-0.0944	-2.24	0.0421
January-95	0.0096	0.23	0.0423
February-95	0.0962	2.13	0.0451
March-95	-0.0267	-0.58	0.0458
April-95	-0.0677	-1.44	0.0471
May-95	-0.1201	-2.40	0.0500
June-95	-0.1868	-3.47	0.0538
July-95	-0.2330	-4.15	0.0561
August-95	-0.2745	-4.90	0.0560
September-95	-0.2391	-4.24	0.0564
October-95	-0.1807	-3.18	0.0568
November-95	-0.0448	-0.81	0.0553
December-95	-0.0007	-0.01	0.0519
January-96	-0.0407	-0.85	0.0481
February-96	0.0353	0.73	0.0480
March-96	0.0458	0.95	0.0482
April-96	-0.1042	-2.08	0.0500
May-96	-0.1401	-2.68	0.0522
June-96	-0.1728	-3.16	0.0546
July-96	-0.2570	-4.68	0.0550
August-96	-0.2765	-5.01	0.0552
September-96	-0.2649	-4.75	0.0558
October-96	-0.2048	-3.71	0.0552
HDD63A Non95	0.1181	49.68	0.0024
HDD63A 95	0.1261	57.39	0.0022
PART_S	-0.0826	-4.28	0.0193
HDD63A*PART_S	0.0023	0.93	0.0024
PART_S95	-0.0742	-3.98	0.0186
HDD63A*PART_S95	-0.0025	-0.88	0.0028

Dependent Variable:	Therms/day
Number of Observations:	30,869
Number of Customers:	856
R-Square:	0.772

The unit net savings estimates based on the regression results are shown in Table 3-6. These savings are per gas or electric customer. The net program savings and unit savings per all customers are shown in Table 3-7. Table 3-8 compares the energy and demand savings determined by the evaluation with those claimed by the program. Net demand savings are calculated by applying the electric energy realization rate to the claimed demand savings.

Table 3-6
Unit Net Savings Based on the Load Impact Models
Direct Assistance Program

1995 DA PROGRAM	NET SAVINGS						
ELECTRICITY	Dependent variable: kWh/day				Variable Mean		Annual Savings per Unit
Program Subset	Variable	Coef.	T for Ho	SE	Pooled regression data set	Cross-sectional tracking (long-run normal)	Regression Estimate
Single Family							
Wx/Ed + Lts							
W/ AC	HDD63A*PART_S95	-0.0169	-1.890	0.009	4.621	5.840	35.9
	CDD72*PART_S95	-0.0071	-0.550	0.013	2.169	1.685	4.4
	PART_S95	-0.2558	-3.360	0.076			93.4
	Total						133.7
	W/O AC						
W/O AC	HDD63A*PART_S95	-0.0169	-1.890	0.009	4.617	5.766	35.5
	CDD72*PART_S95	0.0296	1.220	0.024	0.440	0.312	-3.4
	PART_S95	-0.3221	-5.180	0.062			117.6
	Total						149.8
Refrig	REF_P95	-2.3431	-35.830	0.065			855.8
Multi Family							
Wx/Ed + Lts							
W/ AC	HDD63A*PART_S95	0.0002	0.040	0.007	4.299	5.674	-0.5
	CDD72*PART_S95	0.0325	3.830	0.008	2.171	1.666	-19.8
	PART_S95	-0.4817	-9.180	0.052			175.9
	Total						155.7
W/O AC	HDD63A*PART_S95	0.0002	0.040	0.007	4.463	5.623	-0.5
	CDD72*PART_S95	-0.0236	-1.180	0.020	0.344	0.219	1.9
	PART_S95	-0.1805	-4.030	0.045			65.9
	Total						67.3
Refrig	REF_P95	-1.9537	-42.300	0.046			713.6
Mobile							
Wx/Ed + Lts							
W/ AC	HDD63A*PART_S95	-0.0297	-1.000	0.030	5.010	6.052	65.6
	CDD72*PART_S95	-0.1258	-3.250	0.039	1.598	1.253	57.6
	PART_S95	-0.3135	-1.050	0.299			114.5
	Total						252.0
W/O AC	HDD63A*PART_S95	-0.0297	-1.000	0.030	4.606	5.781	62.7
	CDD72*PART_S95	0.4080	2.170	0.188	0.451	0.293	-43.6
	PART_S95	-0.3096	-1.390	0.223			113.1
	Total						126.3
Refrig	REF_P95	-2.4165	-11.730	0.206			882.6

Table 3-6 Continued
Unit Net Savings Based on the Load Impact Models
Direct Assistance Program

1995 DA PROGRAM	NET SAVINGS						
GAS	Dependent variable: Therms/day				Variable Mean		Annual Savings per Unit
Program Subset	Variable	Coef.	T for Ho	SE	Pooled regression data set	Cross-sectional tracking (long-run normal)	Regression Estimate
Single Family							
	PART_S95	0.0006	0.1100	0.0059			-0.2
	HDD63A*PART_S95	-0.0082	-8.5000	0.0010	4.549	5.689	17.0
	Total						16.8
Multi Family							
	PART_S95	0.0119	2.380	0.005			-4.4
	HDD63A*PART_S95	-0.0136	-16.580	0.001	4.402	5.555	27.6
	Total						23.3
Mobile							
	PART_S95	-0.0742	-3.980	0.019			27.1
	HDD63A*PART_S95	-0.0025	-0.880	0.003	4.797	6.055	5.5
	Total						32.6

Table 3-7
Program Net Savings Based on the Load Impact Models
Direct Assistance Program

Component	Unit Savings (per participant w/ gas/elec service)	Number of Participants	Fraction w/ Gas/Electric Service	Number of Participants w/ Gas/Electric Service	Unit Savings (per all participants)	Program Savings	SE
Electric	**kWh/year**				**kWh/year**	**MWh/year**	**MWh/year**
Single Family							
w/AC Wx/Ed+Lts	133.7	9,186	0.84	7,690	111.9	1,028	166
w/o AC Wx/Ed+Lts	149.8	18,270	0.84	15,294	125.4	2,291	296
Refrigerators	855.8	8,158	1.00	8,158	855.8	6,982	195
Multifamily							
w/AC Wx/Ed+Lts	155.7	3,606	0.84	3,019	130.3	470	47
w/o AC Wx/Ed+Lts	67.3	8,182	0.84	6,849	56.3	461	96
Refrigerators	713.6	1,071	1.00	1,071	713.6	765	18
Mobile Home							
w/AC Wx/Ed+Lts	252.0	1,103	0.84	923	211.0	233	58
w/o AC Wx/Ed+Lts	126.3	1,490	0.84	1,247	105.7	158	122
Refrigerators	882.6	770	1.00	770	882.6	680	58
Total Electric	348.3	44,328	0.85	37,513	294.8	13,066	490
Gas	**Therms/ year**				**Therms/ year**	**Therms/ year (1,000s)**	**Therms/ year (1,000s)**
Single Family							
w/AC Wx/Ed	16.8	9,186	0.84	7,755	14.2	130	15
w/o AC Wx/Ed	16.8	18,270	0.84	15,424	14.2	259	29
Multifamily							
w/AC Wx/Ed	23.3	3,606	0.84	3,044	19.6	71	5
w/o AC Wx/Ed	23.3	8,182	0.84	6,907	19.6	161	11
Mobile Home							
w/AC Wx/Ed	32.6	1,103	0.84	931	27.5	30	6
w/o AC Wx/Ed	32.6	1,490	0.84	1,258	27.5	41	8
Total Gas	19.6	41,837	0.84	35,320	16.5	692	47

Table 3-8
Comparison of Net Evaluation Savings with Program Projections

	Evaluation Results							Program Planning Estimates*					
Electricity	Customers	kWh/ customer	Total MWh	SE(Total MWh)	kW/ customer	Total MW	SE(Total MW)	Customers	kWh/ customer	Total MWh	kW/ customer	Total MW	Realization Rate
Total Weatherization * Lighting	41,83	110.9	4640	44	0.024	1.017	0.098	41,83	22	9,477	0.033	1.363	0.490
Total Refrigerators	10,00	842.6	8426	20	0.106	1.062	0.026	10,00	72	7,293	0.131	1.305	1.155
Total Program	44,32	294.8	13070	44	0.047	2.079	0.071	44,32	37	16,76	0.060	2.668	0.779

	Evaluation Results				Program Planning			
Gas	Customers	Therms/c ustomer	Total Therms (1,000	SE(Total Therms) (1,000	Customers	Therms/c ustomer	Total Therms (1,000	Realization Rate
Total Program	41,83	16.5	69	47	41,83	21.7	90	0.763

*Supplied by PG&E program planners.

3.4.2 Discussion of Findings

Weatherization/Education and Lighting Savings

For gas, the regression results indicate that the unit savings are higher for multifamily homes than for single-family, and higher still for mobile homes. This trend is somewhat surprising, but may reflect lower initial tightness of multifamily and mobile homes. The difference between the mobile homes and multifamily, though apparently large, is not statistically significant. The mobile home estimate is relatively poorly determined, as a result of the smaller number of customers in this group as a basis for the estimate. Across all house types, the evaluation estimates are 76 percent of the program forecast. The difference between the evaluation estimate and the program estimate is significant at better than the 99 percent confidence level.

For electricity in homes without air conditioning, the unit savings for weatherization/education and lighting combined are similar to the program planning estimates for weatherization alone. Planning estimates for lighting are not broken out by house type, and the billing analysis was not able to break out the savings between weatherization and lighting. As a result, a direct comparison between corresponding estimates is not possible at this level. However, it is clear that the evaluation results for the weatherization and lighting components combined are lower than the combined values used for planning.

For homes with air conditioning, the contrast is greater. For single-family homes, the evaluation results show essentially no difference in savings between air conditioned and non air conditioned homes. For multi-family units and mobile homes, the air conditioned savings are higher, but still not as high as the planning estimates. In total across all three housing types with and without air conditioning, the evaluation estimate is about 48 percent of the planning estimate for electricity. The difference between the evaluation estimate and the program estimate is significant at better than the 99 percent confidence level.

Refrigerator Savings

A different story is seen for refrigerators. For all three house types, the evaluation savings is as large as or larger than the planning estimate. Across all three housing types, the refrigerator savings determined by the evaluation are 116 percent of the program projection.

Combining the refrigerator, weatherization, and lighting savings, the realization rate is 77 percent for electricity. The difference between the evaluation results and the planning estimates is significant at the 99 percent confidence level, for both refrigerators alone and electricity overall.

4 ENERGY MANAGEMENT SERVICES

4.1 PROGRAM DESCRIPTION

The EMS Program is designed as follows in PG&E's Annual Summary Report on Demand Side Management Programs in 1995 and 1996 (Revised December, 1996).

Residential Energy Management Services includes both Single Family and Multifamily Property Energy Management Site Surveys, California Home Energy Efficiency Rating System (CHEERS), and the Smarter Energy Line (SEL).

SINGLE FAMILY ENERGY MANAGEMENT SERVICES

The purpose of the program is to provide energy efficiency information to residential customers who live in single family dwellings. This program provides household specific energy use information in a prioritized manner for appliances and systems.

Implementation Strategy

In 1995, PG&E continued to offer the on-site checklist survey and the direct mail Energy Savings Plan (ESP). The appliance end use analyses continued to be the standard energy survey during 1995. The 1995 goal was 15,000 on-site surveys (checklist surveys) and 100,000 direct mail ESP.

Target Market

Single family residential dwelling units.

MULTIFAMILY PROPERTY ENERGY MANAGEMENT SERVICES

The Multifamily Energy Property Management Service program (MFP EMS) assists residential customers in controlling their energy consumption and costs through education. Audits can be performed on all common-use areas of Multifamily Properties.

The efficiency of boilers (water and space heating), lighting and lighting controls, thermal envelopes and pool and spas, HVAC equipment and motors are currently being evaluated for each complex. The information for each component is captured in a software module which provides an assessment of the energy use and recommendations to increase efficiency and dollar savings.

Implementation Strategy

Contact owners/managers.

Provide quality survey and analysis to customers.

Target Market

The eligible multifamily complex contains five or more dwelling units, including apartments, condominiums and mobile home parks (master metered or individually metered). Audits can be performed on each complex once annually.

1995 PROGRAM ACCOMPLISHMENTS

Single Family EMS:

Site Survey	9,988
ESP	100,020
Total	110,008

Multifamily Property EMS:

50,000 units surveyed (78 percent of targeted 64,000).

The under achievement of the target was the result of reductions in program marketing and energy auditors. These reductions were implemented as a response to program Measurement and Evaluation results indicating energy impacts are less than expected. Further reductions are planned for 1996.

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Net Energy Impacts (First Year)

kW	3,503
kWh	19,365,735
therms	1,723,514

(Includes both Single Family and Multifamily EMS)

4.2 SUMMARY OF RESULTS

Table 4-1 summarizes the savings estimated by the evaluation.

Table 4-1
Summary of Net Impact Estimates
Energy Management Services Programs

	Evaluation Results					Program Planning*			
Electricit	Customers	Total MWh	SE(Total MWh)	Total MW	SE(Total MW)	Customers	Total MWh	Total MW	Realization Rate
Single Family									
Onsite	10,013	1,524	596	0.14	0.06	9,988	2,117	0.200	0.720
Mail	100,000	7,395	4379	0.74	0.44	100,020	12,052	1.200	0.614
TOTAL	110,013	8,919	4591	1.45	0.75	110,008	14,169	2.30	0.629
Multifamil	58,282	2,582	1,089	0.55	0.23	58,407	5,607	1.20	0.461
Total Program	168,295	11,501	4,718	2.00	0.78	168,415	19,777	3.5	0.582

	Evaluation Results			Program Planning*		
Gas	Customers	Total Therms (1,000)	SE(Total Therms) (1,000)	Customers	Total Therms (1,000)	Realization Rate
Single Family						
Onsite	10,013	24	60	9,988	36	0.657
Mail	100,000	369	442	100,020	1,000	0.369
TOTAL	110,013	393	461	110,008	1,036	0.379
Multifamil	58,282	400	206	58,407	759	0.526
Total Program	168,295	793	505	168,415	1,795	0.442

Realization rate = Evaluation energy/Planning energy
***Supplied by PG&E Program Planners**

The table shows that the net savings estimated by the evaluation are lower than the program planning estimates. There are several reasons for this shortfall.

1. PG&E had already lowered its unit savings estimates for the 1996 program year for each of the program components. The evaluation estimates are not significantly different from the revised forecasts.
2. The original planning unit gross savings per measure installed may have been overestimated for some measures.
3. For the Single Family program, hot water measure "take rates," the fraction of participants who adopted each type of measure as a result of program participation, are lower than those assumed for planning.
4. First-year savings for measures installed in response to the audit are less than a full year of gross measure savings, because measures are not implemented immediately after participation.

The methods used to develop the evaluation estimates and more detailed results are presented below.

4.3 METHODOLOGY

As described in Section 2, the basis for the impact estimates was a billing analysis to determine net savings. The form of the analysis was different for the single-family and multi-family program components.

4.3.1 Single-Family

The billing analysis methods for the single-family component are described below. For comparison purposes, this evaluation also included calculation of explicit take rates for the measures promoted by the SF EMS program. To provide further insight into the net savings determined by the billing analysis, alternate impact estimates were calculated based on planning estimates of unit gross savings and the evaluation's measured take rates.

Both the billing analysis and the take rate analysis utilized information collected on the evaluation survey of participants and nonparticipants. This survey is described below. The billing analysis and take rate methodologies are then presented.

Evaluation Survey

To support both the billing analysis and the take rate analysis, the evaluation conducted surveys with a sample of participants and nonparticipants. Participants were selected for the sample only if they had a minimum of 12 months of billing history prior to participation and nine months after participation. Nonparticipants were selected only if they had a minimum of 24 months of billing history. These are requirements of the Protocols for inclusion in the analysis sample. A simple

random sample of customers satisfying this criterion was selected for each surveyed group. Table 4-2 shows the number of sampled customers in each category. A copy of the survey instrument is given in Appendix A.

Table 4-2
Customer Surveys

Group	Number of Completed Surveys
Single Family EMS Program Participants	
Onsite	303
Mail	804
Nonparticipants	1,008

Information collected on the survey included

- measures adopted and timing of the installation
- fuels used for end uses
- major changes that have occurred over the study period and the dates of these changes

Billing Analysis

The general form of the billing analysis regression model is described in Section 2. This model is a pooled time series cross-sectional model that combines into a single model all time periods from all customers included in the analysis. The regression model incorporates information from the evaluation survey as well as billing and weather data.

Separate estimates are developed for the onsite and mail components, for electricity and gas. The models control for changes in the home over the study period that would not be related to the influence of the program.

Comparison Group Specification

For the Single-Family EMS Program, the comparison group included in the model was the set of all surveyed nonparticipants. The nonparticipants implicitly control for natural measure adoption. In addition, they control for other changes over the study period that are unrelated to the program but might have affected consumption. These effects are controlled for both explicitly, by including change terms based on survey responses, and implicitly, through the monthly time terms.

Model Specification

The terms included in the regression models are

- Customer-specific dummy variables (included implicitly, but not explicitly estimated by the model)

- Time-period dummy variables for each month in the analysis
- Heating degree-days, base 63^{o}F (separate coefficients for nonparticipants and participants, with and without electric heat)
- Cooling degree-days, base 72^{o}F (electric model only, separate coefficients for nonparticipants and participants, with and without air conditioning)
- Change variables
    - ◊ change in the number of people in the household
    - ◊ additions of floorspace
    - ◊ additions of air conditioning equipment
    - ◊ removals or replacements of major equipment other than air conditioners or refrigerators.
- Time series participation dummy variable, by itself and interacted with heating (and cooling) degree-days.

Take Rate Analysis

As described below, the evaluation survey data on participants and nonparticipants were used to determine the proportion of customers in each group who implemented particular measures promoted by the program. Additional information was used to determine the proportion of participants whose measure implementation was attributable to the program.

The take rate analysis was conducted in two ways. First, a simple comparison was made between the proportion of implementers among participants and nonparticipants. This simple take rate calculation was similar to the method used by the previous M&E study.

The limitation of the simple take rate analysis is that it does not account for self-selection. That is, the customers who choose to participate in the EMS program may be more (or less) inclined to adopt measures even without the program. Thus, the difference in implementation rate between the two groups cannot necessarily be attributed to the effect of the program.

A more reliable take rate analysis makes use of the survey screening questions to determine what fraction of customers installed measures after the audit, and because of it. First, out of all participants who recall receiving the audit or survey, the fraction who implemented each measure of interest after receiving the survey is determined. We refer to this fraction as the gross take rate TR_{GROSS}. Next, out of all those who implemented a measure after receiving the audit/survey, the fraction who would have implemented the measure anyway is determined, based on the screening criteria described below. This fraction is the natural adoption rate (NAR) within the program. The net take rate is then computed as

$$TR_{NET} = (1 - NAR) \times TR_{GROSS}.$$

Screening Questions to Estimate Natural Adoption

For the program participants, the evaluation survey included questions about their participation. These questions were used to determine the effect of the program on measure adoption. That is, of all the participants who installed a given measure after receiving the audit/survey report, what fraction were Natural Adopters who would have installed the measure without the program, and what fraction installed because of the program?

It is well understood that simply asking participants if they would have implemented the measure in the absence of the program can lead to overstatement of natural adoption. The reason is that customers will tend to give the "right" or socially desirable response. In addition, there is a tendency to respond based on their current experience with the measure, rather than on their prior knowledge and understanding. Thus, customers who are satisfied with the measure will say "yes" to indicate that they would consider it worth doing without the audit, not necessarily because they would have done so at the time of implementation.

To overcome some of these limitations with self-reports, we used a series of screening questions. We classify customers as natural adopters only if they had planned to implement the efficiency measure prior to learning of the program, and had already investigated the associated costs. Customers who indicate that they were planning to implement the measure but who were unaware of the cost implications are considered unlikely to have made the efficiency investment on their own. We have applied this screening approach for evaluations of several other programs.

Discussions of Modeling Issues and Approaches

Limitations of the Models

- The savings effects are not strongly significant (statistically) in any of the four models (onsite and mail, gas and electric). The overall savings estimates for the gas models are not at all statistically significant.
- In each of the models, some of the savings terms included have a sign opposite to what would be expected for savings. However, the combined effect of the estimated terms was positive savings for each component and fuel.
- For audit programs in general, the effect of the program lags the time of the audit. Those measures installed in response to the audit recommendations are not implemented immediately. The post-participation period included in this analysis starts immediately after the audit. As a result, the average effect of the audit, through implemented measures, is diminished. This diminishment is appropriate for a first-year effect, since measures implemented because of the program are not in place throughout the first full year after participation.

Data Issues

- We did not have program records on the recommendations made by the audit. This information could have been used in the surveys to focus questions more specifically on measures that would have been relevant in each household, as well as in the regressions to look for effects of the recommendations.
- We collected a large number of surveys both for participants and for nonparticipants. As a result, the estimates of the measure implementation attributable to the program have a strong basis.

Other Efforts Attempted

- Estimate gross savings associated with individual measures by including terms for the addition of measures at the times reported by participants and nonparticipants. These models gave erratic and unreasonable estimates for the separate measure effects, including estimates of the wrong sign for several measures. We attribute the failure of these models to the small effects of most of the measures of interest, combined with unreliable customer-reported installation dates.
- Fit the net savings models without the terms controlling for other changes. These fits gave much higher savings for some components and much lower savings for others. These results indicate the importance of including the change terms, which generally were more statistically significant (had higher t-values) than the savings terms of interest.
- Exclude time periods within the one month prior to participation and the six months following, for each participant. This approach was intended to address the problem that the effect of the audit would not be seen immediately, because measures would not be implemented right away. However, the Protocols require nine months of post-participation data in the analysis. Excluding the first six months means that only participants from July 1995 or earlier could be included, since our last billing data were for October 1996. This exclusion eliminated the great majority of our surveyed participants from the analysis. The program timed promotional efforts for seasons when good response rates were anticipated. The result was that most of the participation occurred late in the year.

4.3.2 Multifamily

Billing Analysis

The multifamily common area customers who were candidates for participation in the PG&E multifamily rebate and audit programs can be distinguished from the other residential customers in a number of ways:

- In many cases a customer is served through multiple meters with multiple PG&E accounts; accurately identifying and aggregating all the meters affected by a particular audit is difficult;

- Many of the changes implemented in response to the audit involve significant change-outs of equipment that can occur over multi-month periods; and
- Locating the customer contact who is knowledgeable about the audit, measures implemented, or other nonprogram site changes can be difficult because of changeover in property managers and physical separation of the property manager from the affected complex.

These factors contributed to a somewhat different modeling approach than that used for the other residential programs. First, a cross-sectional model that relies on annual data was used instead of the pooled time series/cross-sectional model that relies on monthly data. The annual model mitigated problems encountered in aggregating multiple accounts into an accurate monthly billing history (meter read dates for a given site did not always line up). In addition, the annual model was better able to accommodate measure installations that extended over a number of months.

Second, the limited ability to locate the appropriate site contact person at each site precluded the effective use of surveys to identify nonprogram factors that could affect energy use. (For a similar 1993 multifamily study, surveys conducted for 450 sites, but none of the nonprogram variables developed from the surveys were significant in the billing analysis.) The models utilized in this study rely only on billing, weather, and tracking system data.

Finally, because of the significant difficulties in identifying all the PG&E meters that serve the common area of the multifamily complexes, all the participants included in the study were taken from a subset of customers who had received audits. As part of the audit process PG&E collects billing control numbers for all the common area meters at an audited complex.

General Annualized Model

The energy model regression analysis uses a cross-sectional change-in-consumption model specification. Each customer's billing history is divided into three periods: a pre-audit period, a blackout period, and a post-audit period. The blackout period is chosen to be sufficiently large to maximize the probability that the measure installation occurs within this period. Then pre- and post-audit billing data (viewed on an annual basis) are compared as part of the billing analysis.

For the regression models, annual post-audit energy consumption per dwelling is explained as a function of annual pre-audit consumption per dwelling unit, a variable or variables identifying program participation, and weather variables:

$$Use_{i,Post} = \alpha + \beta_0 Use_{i,Pre} + \beta_1 Part_i + \beta_2 \Delta HDD_i + \beta_3 \Delta CDD_i + \varepsilon_i$$

where:

$Use_{i,Post}$ = post-audit period consumption per dwelling unit for customer *i*

$Use_{i,Pre}$ = pre-audit period consumption per dwelling unit for customer *i*

$Part_i$ = the Program participation variable for customer i, either a 0/1 dummy variable indicating the customer is a participant (audit program equations) or the engineering-based estimate of program savings from the program tracking system (rebate program equation)

ΔHDD_i = Change in heating degree days, 65°F base, between the pre-audit and the post-audit periods for customer i

ΔCDD_i = Change in cooling degree days, 70°F base, between the pre-audit and the post-audit periods for customer i

α, β's = estimated parameters

ε_i = random error term

The parameter of interest in this equation is β_1, the coefficient for the program savings variable. When the program savings variable is a 0/1 dummy variable, this coefficient represents the average energy savings per dwelling unit associated with program participation. When the participation variable is expected savings, this parameter represents the estimated realization rate, the fraction of tracking system savings realized in customer bills.

Interpretation as net savings

For each of the multifamily models, the change in bills for program participants is compared against the change in bills for a comparison group. No attempt was made to exclude nonparticipants who had undertaken nonprogram energy efficiency activities. In addition, nonprogram energy efficiency activities were not controlled for in the regression equations. Under these conditions, the nonparticipant comparison group accounts for naturally occurring energy efficiency activity. Thus, the model estimates the net effects of program participation.

Construction of Data Sets for Billing Analysis

As described above, an annual billing analysis was used to directly estimate net audit program savings by comparing changes in energy use for a participant group against changes in energy use for a comparison group. These groups were defined as follows:

- Participant group: customers who received multi-family audits in 1995 and did not participate in any other PG&E program during the 1994-1996 period.
- Nonparticipant comparison group: multi-family customers who did not participate in any PG&E program during the 1994-1996 period. These customers consisted of a combination of 1993 audit participants, 1993 rebate participants, and additional nonparticipants who were included in a study of PG&E's 1993 Multi-Family Properties Program. This group was chosen because of the availability of complex size data (number of dwelling units) that was required by the model.

Prior to inclusion in the final models, customers were screened for adequacy of billing data (complete billing histories, at least 12 months pre-audit data and at least 9 month of post-audit

data). In addition, customers whose bills had changed by over 50 percent between the pre- and post- periods were eliminated because these changes were considered too large to be handled within the existing model structure. Finally, several large outliers were removed from the final analysis (2 electric customers and 1 gas customer with studentized residuals greater than 6). Table 4-3 presents the counts of participants and nonparticipants included in the final models.

Table 4-3
Customers in Final Multi-Family Audit Models

Customer Group	Electric Model	Gas Model
Participants	176	196
Nonparticipants		
1993 Audit Participants	130	124
1993 Rebate Participants	102	93
1993 Audit/Rebate Part.	75	66
Nonparticipants in 1993 study	108	93
Total Nonparticipants	413	376

In order to implement the billing analysis models, annualized bills for the 1996 period (January 1996 through October 1996) were compared against annualized bills for 1994. The entire 1995 period was "blacked out" of the analysis in order to allow the maximum amount of time for program participants to implement audit recommendations while maintaining at least 9 months of post-audit data as required by the M&E Protocols.

4.3.3 Participation Counts for SF and MF Program Components

Both program planning estimates and evaluation estimates are developed on a per-unit basis. To make sense of these unit estimates, it is necessary to know how a unit is defined. To compare the estimates, it is necessary to put them on a common basis.

Program Planning Estimates

The units used for the program planning estimates are households served by each program component, Single-Family Onsite, Single-Family Mail, and Multifamily. The program counted the 20 surveys conducted by phone in the mail total.

Evaluation Estimates

The evaluation estimates are developed from billing analysis for electricity and gas. The resulting estimates are per participant with the particular fuel type. Total program savings are determined by multiplying the unit estimates by the number of customers in each component with the given fuel type.

Thus, for each subgroup, we had to estimate the number of customers with each fuel type. For the Single Family components, we could identify the total customers served from the tracking

data, but could not determine the type of service for all of them. We therefore estimated the fractions with each type of service from the fractions we found among those for whom we collected survey data. This group was a random sample from the pool of all participants with adequate billing histories.

Table 4-4 summarizes the program-reported counts and the evaluation counts.

Table 4-4
Program and Evaluation Counts

	Program Planning*	Tracking Data	Evaluation			Notes on Evaluation Count
			Total	Electric	Gas	
SF Mail	100,020	100,000	100,000	98,157	83,410	tracking excludes 20 phone
SF Onsite	9,988	10,013	10,013	9,345	7,032	includes phone
MF	58,407	58,282	58,282	58,117	48,998	
Total Households Served	168,415	168,295	168,295	165,619	139,440	

*Supplied by PG&E Program Planners

4.4 RESULTS

4.4.1 Single-Family

Net Savings from Billing Analysis

Table 4-5 lists the variables used in the pooled single-family regression model. The attrition analysis, indicating which customers were included in the regressions, is summarized in Table 4-6. Results of the regression are shown in Table 4-7. The net savings estimates based on the regression results are shown in Table 4-8.

Table 4-5
Variables Included in the Pooled Regression Model
Single Family EMS

Variable	Description
HDD63	HDD/Day Base 63°F
CDD72	CDD/Day Base 72°F
ONS95	Cross-Sectional On-Site Audit Program Participant Dummy
ESPM95	Cross-Sectional Mail Audit Program Participant Dummy
PSTONS95	Time Series Post On-Site Audit Participation Dummy
PSTESPM	Time Series Post Mail Audit Participation Dummy
DSQFT	Added Square Footage to Home
DNPEOP	# of People Changed (-1/0/+1)
RPLCO	Replaced Other Appliances
UNOTR	Unplugged Other Appliances

Table 4-6
Attrition Analysis

ELECTRIC Screen	Mail		On-site		Nonparticipants	
	# Cases Left	# Screened out	# Cases Left	# Screened out	# Cases Left	# Screened out
Original Surveyed	805		304		1008	
Only in Single Program	802	*3*	302	*2*	977	*31*
Merged w/ Electric Billing Data	749	*53*	294	*8*	861	*116*
Without Major System Change	742	*7*	285	*9*	851	*10*
Single Famiy, Own Home, Pay own Electric	654	*88*	219	*66*	700	*151*
Max. kWh 15-100/day	639	*15*	196	*23*	618	*82*
No Missing Data for Regression	588	*51*	171	*25*	561	*57*
GAS **Screen**	**Mail**		**On-site**		**Nonparticipants**	
	# Cases Left	# Screened out	# Cases Left	# Screened out	# Cases Left	# Screened out
Original Surveyed	805		304		1008	
Only in Single Program	802	*3*	302	*2*	977	*31*
Merged w/ Gas Billing Data	620	*182*	185	*117*	752	*225*
Without Major System Change	614	*6*	184	*1*	741	*11*
Single Famiy, Own Home, Pay own Electric	543	*71*	148	*36*	620	*121*
Max. Therms 0-20/day	543	*0*	148	*0*	620	*0*
No Missing Data for Regression	504	*39*	127	*21*	568	*52*

Table 4-7
Net Load Impact Regression Model
Single Family EMS

Dependent Variable:	Gas	Electric				Variable Mean		
# of Customers:	Therms/day 1,199	kWh/day 1,320				Pooled regression data set	Cross-Sectional Tracking Data (long-run normal)	Annual Savings per Unit
# of Observations:	49,429	66,024						
R2:	0.782	0.765						
Program/Subset	**Variable**	**Description**	**Coefficient**	**T**	**SE**			
Gas								Th/year
Onsite	HDD63*PSTONS95	HDD/da	-0.0027	-0.59	0.0046	4.41	5.93	5.88
	PSTONS95	Onsite dummy	0.00697	0.27	0.0261	1.00	1.00	-2.54
		Total						**3.34**
Mail	HDD63*PSTESPM	HDD/da	-0.0075	-2.65	0.0029	4.58	5.87	16.28
	PSTESPM	Mail dummy	0.03247	1.92	0.0169	1.00	1.00	-11.8
		Total						**4.43**
Electric								kWh/year
Onsite	HDD63*PSTONS95	HDD/da	-0.0478	-1.32	0.0364	4.78	5.93	103.72
	CDD72*PSTONS95	CDD/da	-0.0641	-1.26	0.0508	1.46	1.18	27.63
	PSTONS95	Onsite dummy	-0.0866	-0.35	0.2506	1.00	1.00	31.61
		Total						**162.96**
Mail	HDD63*PSTESPM	HDD/da	-0.0208	-0.83	0.0251	4.64	5.87	44.64
	CDD72*PSTESPM	CDD/da	0.08695	2.63	0.0331	1.25	1.00	-31.6
	PSTESPM	Mail dummy	-0.1706	-1.05	0.1622	1.00	1.00	62.30
		Total						**75.28**

Table 4-8
Net Savings Based on the Load Impact Model
Single Family EMS

Component	Unit Savings (per participant w/ gas/elec service)	Number of Participants	Fraction w/ Gas/Electric Service	Number of Participants w/ Gas/Electric Service	Unit Savings (per all participants)	Program Savings	SE
Gas	Therms/year				Therms/year	Therms/year	Therms/year
ONSITE	3.34	10,013	0.70	7,032	2.36	23,641	59,553
MAIL	4.43	100,000	0.83	83,410	3.69	369,365	442,003
TOTAL GAS	**4.35**	**110,013**	**0.82**	**90,442**	**3.57**	**393,006**	**460,581**
Electric	kWh/yea				kWh/yea	kWh/yea	kWh/yea
ONSITE	163.0	10,013	0.93	9,345	152.2	1,524,021	595,549
MAIL	75.3	100,000	0.98	98,157	73.9	7,394,543	4,378,787
TOTAL ELECTRIC	**82.96**	**110,013**	**0.98**	**107,502**	**81.07**	**8,918,564**	**4,590,881**

Gas Savings

The savings results for gas are not statistically significant. The point estimates are lower than the planning estimates (3.3 therms/year vs. 4 therms/year for the onsite component and 4.4 therms/year vs. 10 therms/year for the mail component). However, the error bands are wide enough that they do not contradict the planning estimates. The standard error of the estimate is larger than the estimate itself. The 90 percent confidence band for the total program is from -3.3 to +10.45 therms per year per participant.

On the other hand, the lower than projected gas savings are supported by the take rate analysis described below. For gas, the only measures explicitly targeted by the program are water measures. These measures had lower take rates than were incorporated into the planning estimates. With a low rate of measure adoption, the average effect on participants' bills was too small to be detected reliably with this analysis.

Electric Savings

The electricity savings are more reliably estimated than the gas savings. The standard error of the estimate is about half the size of the estimate itself. The 90 percent confidence interval for total electricity savings is from 39 to 150.

The point estimates are again lower than the original planning estimates. The original planning estimates of unit savings were 212 kWh/year for the onsite component, and 122 kWh/year for the mail components. However, these estimates were revised in 1996 to 157 kWh/year and 67 kWh/year, respectively. The evaluation results are quite consistent with the revised planning estimates. For more insight into the savings findings, we turn to the estimates of measure adoption attributable to the program.

Take Rate Analysis

The estimates presented in Table 4-7 are the final net savings estimates for the evaluation. To explore some of the factors underlying these estimates, we compare take rates determined by the evaluation with those assumed for planning.

Table 4-9 shows the measure adoption rate for participants and nonparticipants, based on the evaluation survey responses. The simple net take rate, calculated as the difference between the two groups' adoption rates, is also shown. Except for compact fluorescent bulbs, the measures listed in the table are those that were explicitly identified in the program materials as being promoted, and for which savings were projected.

Table 4-9
Measure Adoption Rates and Simple Take Rate Calculation

	How Many Implemented Since--	N =	Replace Refrigerator	Replace Freeze	Unplug Refrig/ Freez	Low-Flo Showerheads	Tank Wrap	Compact Fluorescent
SAMPLE COUNTS OUT OF --								
All Nonparticipant	end of 1993	1008	157	23	35	152	144	105
All Mail Participants	end of 1993	804	183	32	36	150	130	119
All Onsite Participants	end of 1993	303	71	11	21	61	34	53
Mail Participants who remember the audi	audit	489	56	14	13	28	21	39
Onsite Participants who remember the audit	audit	243	42	7	8	12	7	19
AS FRACTIONS OF --								
All Nonparticipant	end of 1993	1008	15.6%	2.3%	3.5%	15.1%	14.3%	10.4%
All Mail Participants	end of 1993	804	22.8%	4.0%	4.5%	18.7%	16.2%	14.8%
All Onsite Participants	end of 1993	303	23.4%	3.6%	6.9%	20.1%	11.2%	17.5%
Mail Participants who remember the audi	audit	489	11.5%	2.9%	2.7%	5.7%	4.3%	8.0%
Onsite Participants who remember the audit	audit	243	17.3%	2.9%	3.3%	4.9%	2.9%	7.8%
Simple Net Take Rate = P% - NP%								
Mail			**7.2%**	**1.7%**	**1.0%**	**3.6%**	**1.9%**	**4.4%**
Onsite			**7.9%**	**1.3%**	**3.5%**	**5.1%**	**-3.1%**	**7.1%**

The more complete take rate analysis based on the survey screening questions is presented for onsite participants in Table 4-10 and for mail participants in Table 4-11. This analysis is based only on participants who recalled the audit/survey.

The net take rates determined by the more complete analysis are generally somewhat higher than those determined from the simple comparison of adoption rates. However, the rates estimated by the two methods are similar in magnitude.

Table 4-10
Gross and Net Take Rates Based on Screened Onsite Participants

			PERCENT:	**17.3%**	**2.9%**	**3.3%**	**4.9%**	**2.9%**	**7.8%**
	NATURAL ADOPTION RATE CALCULATION								
	SAMPLE COUNTS								
AND	Prior to receiving the survey from PG&E, were you aware of the energy savings advantages of the measure?	YES		21	4	1	9	3	10
AND	Prior to receiving the survey from PG&E, were you aware of the cost of measure	YES		17	3	1	6	2	6
AND	Prior to receiving the survey from PG&E, were you planning on implementing the measure?	YES		10	3	1	4	2	1
AND	If you had not received the survey from PG&E, wha would you most likely have done?	Implemente within 1 yea		8	3	1	3	2	1
	PERCENT OF GROSS IMPLEMENTERS								
AND	Prior to receiving the survey from PG&E, were you aware of the energy savings advantages of the measure	YES		50.0%	57.1%	12.5%	75.0%	42.9%	52.6%
AND	Prior to receiving the survey from PG&E, were you aware of the cost of measure	YES		40.5%	42.9%	12.5%	50.0%	28.6%	31.6%
AND	Prior to receiving the survey from PG&E, were you planning on implementing the measure?	YES		23.8%	42.9%	12.5%	33.3%	28.6%	5.3%
AND	If you had not received the survey from PG&E, wha would you most likely have done?	Implemente within 1 yea	NATURAL ADOPTION RATE:	**19.0%**	**42.9%**	**12.5%**	**25.0%**	**28.6%**	**5.3%**
	NET TAKE RATE = GROSS TAKE RATE X (1-NAR)			**14.0%**	**1.6%**	**2.9%**	**3.7%**	**2.1%**	**7.4%**
	PLANNING TAKE RATE			**12.0%**	**1.1%**	**7.0%**	**4.6%**	**8.7%**	

For the onsite component, the estimated take rates are lower than the planning estimates for unplugging refrigerators, low-flow showerheads, and water heater wrap, and slightly higher for refrigerator and freezer replacement. The lower than expected take rates for unplugging refrigerators and tank wrap accounts for some of the short fall in savings found by the billing analysis.

Table 4-11
Gross and Net Take Rates Based on Screened Mail Participants

Participants who recall having the mail audit 489

	Question	Response		Replace Refrigerator	Replace Freeze	Unplug Refrig/Freeze	Low-Flow Showerheads	Tank Wrap	Compact Fluorescent
	GROSS TAKE RATE:								
	Implemented measure after receiving the audi		SAMPLE COUNT:	56	14	13	28	21	39
			PERCENT:	**11.5%**	**2.9%**	**2.7%**	**5.7%**	**4.3%**	**8.0%**
	NATURAL ADOPTION RATE CALCULATION								
	SAMPLE COUNTS								
AND	Prior to receiving the survey from PG&E, were you aware of the energy savings advantages of the measure?	YES		43	12	1	21	14	27
AND	Prior to receiving the survey from PG&E, were you aware of the cost of measure	YES		34	7	1	15	9	15
AND	Prior to receiving the survey from PG&E, were you planning on implementing the measure?	YES		14	2	1	11	7	9
AND	If you had not received the survey from PG&E, wha would you most likely have done?	Implemente within 1 yea		14	2	1	11	7	9
	PERCENT OF GROSS IMPLEMENTERS								
AND	Prior to receiving the survey from PG&E, were you aware of the energy savings advantages of the measure	YES		76.8%	85.7%	7.7%	75.0%	66.7%	69.2%
AND	Prior to receiving the survey from PG&E, were you aware of the cost of measure	YES		60.7%	50.0%	7.7%	53.6%	42.9%	38.5%
AND	Prior to receiving the survey from PG&E, were you planning on implementing the measure?	YES		25.0%	14.3%	7.7%	39.3%	33.3%	23.1%
AND	If you had not received the survey from PG&E, wha would you most likely have done?	Implemente within 1 yea	NATURAL ADOPTION RATE:	**25.0%**	**14.3%**	**7.7%**	**39.3%**	**33.3%**	**23.1%**
	NET TAKE RATE = GROSS TAKE RATE X (1-NAR)			**8.6%**	**2.5%**	**2.5%**	**3.5%**	**2.9%**	**6.1%**

For the mail component, the take rates were not explicitly specified in the planning documentation, but the overall savings were expected to be half as great as for the onsite component. Table 4-9 shows mail take rates similar to those for the onsite component. The one exception is refrigerator replacement. This measure was promoted in particular by both program components, and has a high expected savings. This measure had the highest take rates in both components, with the onsite take rate 63 percent higher than that for the mail component. Refrigerator replacement apparently accounts for much of the savings observed in the billing analysis. The difference between the onsite and mail take rates is reflected in the corresponding savings estimates.

Comparison of Net Savings Based on Estimated Take Rates

For comparison, Table 4-12 shows the net savings estimates implied by the net take rates shown in Table 4-10 and Table 4-11, applying the unit gross savings used for program planning. The resulting estimates are much higher than the final net savings determined by the billing analysis, particularly for the mail component.

Table 4-12
Gross and Net Savings Based on Take Rates and Program Unit Gross Savings

		Replace Refrigerator	Replace Freeze	Unplug Refrig/Freez	Low-Flo Showerheads	Tank Wrap	
		Onsite Participants					
ELECTRICITY (annual kWh)							**TOTAL**
Gross Savings Per Measure	(Program estimate)	782	782	1125	495	958	
Gross Savings per Household	(Measure savings x gross take rate)	135	23	37	24	28	247
Net Savings per Household	(Measure savings x net take rate)	109	13	32	18	20	193
GAS (annual therms)							
Gross Savings Per Measure	(Program estimate)				10	36	
Gross Savings per Household	(Measure savings x gross take rate)	0	0	0	0	1	2
Net Savings per Household	(Measure savings x net take rate)	0	0	0	0	1	1
		Mail Participant					
ELECTRICITY (annual kWh)							**TOTAL**
Gross Savings Per Measure	(Program estimate)	782	782	1125	495	958	
Gross Savings per Household	(Measure savings x gross take rate)	90	22	30	28	41	211
Net Savings per Household	(Measure savings x net take rate)	67	19	28	17	27	159
GAS (annual therms)							
Gross Savings Per Measure	(Program estimate)				10	36	
Gross Savings per Household	(Measure savings x gross take rate)	0	0	0	1	2	2
Net Savings per Household	(Measure savings x net take rate)	0	0	0	0	1	1

For gas, the net savings based on the take rates is somewhat lower than the final estimate determined by the billing analysis. As noted, the 90 percent confidence bounds around the billing analysis estimate are quite wide. Both the original planning estimates and the estimate based on the take rate are included within these bounds.

For electricity, the net savings based on the take rates are higher than the estimates from the billing analysis. One reason for the disparity is likely to be the magnitude of PG&E's planning gross savings estimates. For some of the measures, these estimates are higher than those we have seen for similar measures in other programs. As a rough basis of comparison, we have substituted alternate unit gross savings estimates, based on our experience with other programs.

The resulting estimates, shown in Table 4-13, are more consistent with the billing analysis results. The alternate estimate is somewhat lower than the billing analysis result for the onsite component, somewhat higher for the mail component.

The alternate gross savings estimates presented in Table 4-13 are not suggested as revised planning estimates for the program. These alternate estimates are not based on rigorous review of secondary sources or characteristics of participating customers. Rather, rough estimates are provided based on prior experience, as a qualitative indicator that some of the planning estimates might need to be reviewed.

Table 4-13
Gross and Net Savings Based on Take Rates and Alternate Unit Gross Savings

		Replace Refrigerator	Replace Freeze	Unplug Refrig/Freez	Low-Flo Showerheads	Tank Wrap	
Onsite Participants							
ELECTRICITY (annual kWh)							**TOTAL**
Gross Savings Per Measure	(Alternate estimate)	450	450	1125	495	600	
Gross Savings per Household	(Measure savings x gross take rate)	78	13	37	24	17	170
Net Savings per Household	(Measure savings x net take rate)	63	7	32	18	12	133
Mail Participant							
ELECTRICITY (annual kWh)							**TOTAL**
Gross Savings Per Measure	(Alternate estimate)	450	450	1125	495	600	
Gross Savings per Household	(Measure savings x gross take rate)	90	22	30	28	26	196
Net Savings per Household	(Measure savings x net take rate)	39	11	28	17	17	112

The final net savings numbers for this evaluation are those determined by the billing analysis. The comparison with the results of the take rate analysis indicates that the lower than originally projected savings per audited participant result from a combination of lower net take rates and lower gross savings per installed measure for some of the measures.

4.4.2 Multi-Family

Table 4-14 (electric) and Table 4-15 (gas) present the variables utilized in the billing analysis models along with their descriptions.

Table 4-14
1995 Multi-Family Audit Program - Electric Model Variables

Variable	Description
POSKWHU	Dependent Variable: Post-audit (1996) annualized kWh per dwelling unit
PREKWHU	Pre-audit (1994) annualized kWh per dwelling unit
AUD95P	0/1 dummy variable, 0 for nonparticipants, 1 for participants
DHDD65I	Annual heating degree days, 65F base, interacted with a heating index
DCDD70I	Annual cooling degree days, 70F base, interacted with a cooling index

Table 4-15
1995 Multi-Family Audit Program - Gas Model Variables

Variable	Description
POSTHMU	Dependent Variable: Post-audit (1996) annualized therms per dwelling unit
PRETHMU	Pre-audit (1994) annualized therms per dwelling unit
AUD95P	0/1 dummy variable, 0 for nonparticipants, 1 for participants
DHDD65	Annual heating degree days, 65F base

For the electric model, heating and cooling degree days variables were interacted with heating and cooling index variables. These variables were added to allow for different weather sensitivity among customers and especially to eliminate heating and cooling responses for customers who didn't have heating and/or cooling loads. (Many complexes have lighting-only loads.) The heating index was defined as average winter usage (January/February) divided by average fall usage (October/November). The cooling index was defined as average summer usage (July/August) divided by average spring usage (April/May). An index of 1.2 or less was set to zero. Indices were not used in the gas equation because most multifamily gas use was deemed to be weather sensitive

The estimated electric and gas equations are presented in Table 4-16 and Table 4-17.

Table 4-16
1995 Multi-Family Audit Program - Electric Model
Dependent Variable POSKWHU - Post Audit kWh/Unit

Variable	Parameter Estimate	Standard Error	t-statistic
INTERCEPT	29.2145	11.5402	2.5320
PREKWHAU	0.9550	0.0017	565.4630
AUD95P	-44.4314	18.7349	-2.3720
DHDD65I	0.0401	0.0151	2.6490
DCDD70I	0.1662	0.0335	4.9570
Number of Observations	589		
R^2	0.9982		

Table 4-17
1995 Multi-Family Audit Program - Gas Model
Dependent Variable POSTHMU - Post Audit Therms/Unit

Variable	Parameter Estimate	Standard Error	t-statistic
INTERCEPT	27.6844	10.9214	2.5350
PRETHMAU	0.8726	0.0049	176.9870
AUD95P	-8.1564	4.2028	-1.9410
DHDD65	0.0159	0.0096	1.6470
Number of Observations	572		
R^2	0.9822		

For both models, all variables have the appropriate signs and are reasonably significant (t-statistics greater that 1.65 indicate significance at the 90% confidence level). The coefficients on the program participation variables (AUD95P) reflect net savings per dwelling unit. Estimated savings are 44 kWh and 8 therms per dwelling unit.

Demand Savings

The evaluation estimate of kW demand savings per dwelling unit was developed using PG&E's relationship between demand and energy savings as follows:

$$kW_{Eval} = kWh_{Eval} \times \frac{kW_{PG\&E}}{kWh_{PG\&E}} = 44.4314 \times 0.000214 = 0.00951.$$

Program-Level Savings Results

Net program savings are calculated by multiplying unit savings estimates by the total number of affected units as indicated in the program tracking system. These results are presented in Table 4-18. Overall the program is estimated to be saving 2.6 million kWh 537 kW, and 0.4 million therms per year.

Table 4-18
1995 Multifamily Audit Program - Program Level Savings

Component	Unit Savings (per Electric/Gas Customer	Number of Units	Program Savings	Standard Error	90% Confidence Interval
Electric Savings (kWh/yr)	44.4314	58,117	2,582,220	1,088,819	791,112 - 4,373,327
Electric Savings (kW)	0.0095	58,117	552.7	233.0	169.3 - 936.1
Gas Savings (Thm/yr)	8.1564	48,998	399,647	205,928	60,895 - 738,399

The evaluation results are compared to PG&E's expected savings in Table 4-19. As the table indicates, the evaluation results are about half of PG&E's original estimates. The planning estimates are outside the 90 percent confidence intervals for both electricity and gas. The main sources of differences are PG&E's higher per unit savings estimates - 96 kWh/unit for electric and 15 therms/unit for gas (averages for complexes that have the target fuel type).

Table 4-19
1995 Multifamily Audit Program - Comparison to PG&E Estimates

Component	Evaluation Savings	PG&E Estimate	Realization Rate
Electric Savings (kWh/yr)	2,582,220	5,607,072	0.46
Electric Savings (kW)	552.7	1,168	0.47
Gas Savings (Thm/yr)	399,647	759,291	0.53

One factor that may cause the evaluation models to underpredict savings involves the limited post-audit period available for the billing analysis. In many cases, customers may not implement audit recommendations immediately after the audit. It is possible that many customers implemented audit recommendations well into the 1996 post-audit period used in the billing model, and the model did not see a full year of post-implementation bills, but rather, a combination of pre-implementation and post-implementation bills. To mitigate these billing analysis problems, it would have been preferable to increase the black out period into 1996 and to extent the post period to a full year. Timing of the evaluation and the Protocol's requirements of 9 months of impact year data precluded these options.

It should be noted that PG&E had already lowered its unit savings estimates for the 1996 program year to 58 kWh/year and 9.7 therms/year. These latter estimates are not significantly different from the evaluation results.

4.4.3 Total Program Savings

The savings results for the program as a whole are summarized in Table 4-19. For the program as a whole, the realization rates relative to the program forecast were 59 percent for electric energy, 58 percent for electric demand, and 46 percent for gas.

Table 4-20
Evaluation Net Savings Estimates Compared with Program Projection
EMS Program

	Evaluation Results							Program Planning*				
Electricit	Customers	kWh/ customer	Total MWh	SE(Total MWh)	kW/ customer	Total MW	SE(Total MW)	Customers	kWh/ customer	Total MWh	Total MW	Realization Rate
Single Famil												
Onsite	10,013	152	1,524	596	0.0144	0.14	0.06	9,988	212	2,117	0.20	0.720
Mail	100,000	74	7,395	4,379	0.0074	0.74	0.44	100,020	121	12,052	1.20	0.614
TOTAL	110,013	81	8,919	4,591	0.0080	0.88	0.45	110,008	129	14,169	1.40	0.629
Multifamil	58,282	44	2,582	1,089	0.0092	0.54	0.23	58,407	96	5,607	1.17	0.461
Total Program	168,295	68	11,501	4,718	0.0084	1.42	0.51	168,415	117	19,777	2.57	0.582 MWh/MWh 0.553 MW/MW

	Evaluation Results				Program Planning*			
Gas	Customers	Therms/ customer	Total Therms (1,000)	SE(Total Therms) (1,000)	Customers	Therms/ customer	Total Therms (1,000)	Realization Rate
Single Famil								
Onsite	10,013	2.36	24	60	9,988	4	36	0.657
Mail	100,000	3.69	369	442	100,020	1	1,000	0.369
TOTAL	110,013	3.57	393	461	110,008	9	1,036	0.379
Multifamil	58,282	6.86	400	206	58,407	13	759	0.526
Total Program	168,295	4.71	793	505	168,415	11	1795	0.442 Th/Th

*Supplied by PG&E Program Planners

A

SURVEY INSTRUMENT

This survey instrument was designed to support impact evaluation of the following programs:

1994

- Central Air Conditioner Rebate Program
- Insulation Rebate Program

1995

- Single Family Energy Management Service Programs (onsite and mail components)
- Home Energy Savings Loan Programs

The evaluation of the 1994 programs is reported separately in a document entitled*: 1994 Residential Weatherization Retrofit Incentives and Appliance Efficiency Incentives Programs Impact Evaluation*.

PG&E Residential Programs Impact Evaluation
Survey
(Participants in audit, AC rebate, weatherization rebate, and HESL programs and Nonparticipants)

FINAL

Telephone Survey

Prepared by

XENERGY Inc.

I. INTRODUCTION SECTION

Hello, this is _____, calling from Atlantic Marketing Research. May I speak with (CONTACT NAME)? (IF THIS PERSON IS AVAILABLE, PROCEED. IF NOT, READ:) May I speak to the person who is the most familiar with energy use in your household. IF THIS PERSON IS NOT AVAILABLE, GET HIS/HER NAME AND MAKE ARRANGEMENTS TO CALL LATER. IF ASKED WHO IS SPONSORING THE SURVEY, REPLY, “PG&E.”

PSC. PARTICIPANT SCREENER SECTION

PSC1 First, I want to make sure that I reached you at (READ ADDRESS) Is this your correct address?

Yes 1
No (THANK AND TERMINATE)..... 2
Don't know..... 999

PSC2 Is this address your home, a place of business, or both?

Home (CONTINUE) 1
Place of business (THANK AND TERMINATE) 2
Both (CONTINUE)..... 3

HH. HOUSEHOLD CHARACTERISTICS SECTION

HH1 How long have you lived at this address [IF NECESSARY, READ LIST] Has it been ..?

- Less than one year 1
- One to two years 2
- Two to three years 3
- Three to five years 4
- Five to ten years 5
- More than ten years 6
- Don't know 999

HH2 Do you plan to move within the next two years?

- Yes 1
- No 2

HH3 What kind of home do you live in? Is it a ...[READ LIST]

- Single-family house detached from any others 1
- Single-family house attached to one or more other homes 2
- Building for two to four families 3
- Building for five or more families 4
- Mobile home 5
- Other (Specify) _____ 6
- Don't Know 999
- Refused 888

HH4 Do you own or rent this residence?

- Own/buying (SKIP TO QUESTION HH6) 1
- Rent/lease 2
- Other (specify)_____ 3
- Refused 888

HH5 Do you pay the electric bill, or is it paid by your building owner/manager?

- Paid by tenant 1
- Paid by building owner/manager 2
- Don't know 3

HH6 Do you have gas service at this location?

- Yes 1
- No (SKIP TO HH8) 2
- Don't know (SKIP TO HH8) 999

HH7 [IF Q. HH4 = '1' SKIP TO Q. HH8] Do you pay the gas bill, or is it paid by your building owner/manager?

Paid by tenant 1
Paid by building owner/manager 2
Don't know 3

HH8 What is the size in square feet of the heated portion of your home?

Number of square feet (SKIP TO SECTION EC) ..... _____
Don't know 1

HH9 What is your best estimate of this area? (READ LIST)

Less than 600 square feet 1
600 to 999 square feet 2
1,000 to 1,599 square feet 3
1,600 to 1,999 square feet 4
2,000 to 2,399 square feet 5
2,400 to 2,999 square feet 6
3,000 or more square feet 7
Don't know 999
Refused 888

EC. ENERGY CONSUMPTION SECTION

EC1 Does your heating system serve only this home or does it serve more than one home or apartment?

- Heating system serves only this home 1
- Heating system serves more than one home or apartment 2
- Don't know 999

EC2 What is your main heating fuel? If GAS, PROBE: Is that natural gas from a utility or bottled gas such as propane or LPG? ACCEPT ONLY ONE RESPONSE.

- Natural gas 1
- Electric 2
- Propane, LPG, or bottled gas 3
- Fuel Oil 4
- Wood, kerosene, or coal 5
- Other (SPECIFY)_____ 6
- Don't know 999

EC3 Do you have a secondary or supplemental heating fuel?

- Yes 1
- No (Skip to EC5) 2
- Don't know 999

EC4 What is your secondary heating fuel? If GAS, PROBE: Is that natural gas from a utility or bottled gas such as propane or LPG? ACCEPT ONLY ONE RESPONSE.

- Natural gas 1
- Electric 2
- Propane, LPG, or bottled gas 3
- Fuel Oil 4
- Wood, kerosene, or coal 5
- Other (SPECIFY)_____ 6
- Don't know 999

EC5 What is your water heating fuel? IF GAS, PROBE: Is that natural gas from a utility or bottled gas such as propane or LPG? ACCEPT ONLY ONE RESPONSE.

- Natural gas 1
- Electricity 2
- Propane, LPG, or bottled gas 3
- Fuel Oil 4
- Wood, kerosene, or coal 5
- Other (SPECIFY) _____ 6
- Don't know 999

EC6 What type of air conditioning do you usually use in your home?

- Electric central air conditioning (ASK EC7) 1
- Gas central air conditioning (ASK EC7) 2
- Heat pump (ASK EC7) 3
- Electric room or window air conditioning (SKIP TO EC11) 4
- No air conditioning systems in home (SKIP TO EC19) 5
- Other (SPECIFY) _____ (SKIP TO EC19) 6
- Don't know (SKIP TO EC19) 999

EC7 How often do you use your central air conditioner? Would you say it was on ...

- Almost every day during the summer 1
- Most days during the summer 2
- Fewer than half the days during the summer 3
- Only on the very hottest days 4
- Fewer than 10 days per year 5
- Don't know 999

EC8 In the last three years have you used your air conditioner a different amount from what you just told me?

- Yes 1
- No (SKIP TO EC19) 2
- Don't know (SKIP TO EC19) 999

EC9 Approximately in what month and year did you change your use of your central air conditioner?

1. Month **Code example 04 for April** ..... _____
2. Year **Code example 94 for 1994** ..... _____

IF DON'T KNOW, PROBE FOR SEASON AND YEAR. CODE 13 = WINTER, 14 = SPRING, 15 = SUMMER, 16 = FALL. STILL DON'T KNOW = 999

EC10 How often did you use your air conditioner before?

- Almost every day during the summer 1
- Most days during the summer 2
- Fewer than half the days during the summer 3
- Only on the very hottest days 4
- Fewer than 10 days per year 5
- Don't know 999

SKIP TO EC19

EC11 At what cooling level do you typically operate your room air conditioner during the summer? Is it the coolest temperature, medium temperature or warmest temperature?

Coolest temperature 1
Medium temperature 2
Warmest temperature 3
Don't know (SKIP TO EC15) 999

EC12 In the last three years, have you changed the setting at which you typically operate your room air conditioner?

Yes 1
No (SKIP TO EC15) 2
Don't know (SKIP TO EC15) 999

EC13 Compared to what you said was typical now, how did you used to set your room air conditioner? Was it warmer or cooler than now?

Used to use a warmer setting 1
Used to use a cooler setting 2
Used to use about the same setting (PROBE- inconsistent with EC12) 3
No air conditioner before 4
Don't know 999

EC14 Approximately in what month and year did you make that change?

1. Month **Code example 04 for April** ..... _____
2. Year **Code example 94 for 1994** ..... _____

IF DON'T KNOW, PROBE FOR SEASON AND YEAR. CODE 13 = WINTER, 14 = SPRING, 15 = SUMMER, 16 = FALL. STILL DON'T KNOW = 999

EC15 How often do you use your room air conditioner? Would you say it was on ...

Almost every day during the summer 1
Most days during the summer 2
Fewer than half the days during the summer 3
Only on the very hottest days 4
Fewer than 10 days per year 5
Don't know 999

EC16 In the last three years, have you significantly changed the amount that you use your air conditioner during the summer?

Yes 1
No (SKIP TO EC19) 2
Don't know (SKIP TO EC19) 999

EC17 Approximately in what month and year did you change your use of your room air conditioner?

1. Month **Code example 04 for April** ..... _____
2. Year **Code example 94 for 1994** ..... _____

IF DON'T KNOW, PROBE FOR SEASON AND YEAR. CODE 13 = WINTER, 14 = SPRING, 15 = SUMMER, 16 = FALL. STILL DON'T KNOW = 999

EC18 How often did you use your air conditioner before?

Almost every day during the summer 1
Most days during the summer 2
Fewer than half the days during the summer 3
Only on the very hottest days 4
Fewer than 10 days per year 5
Don't know 999

EC19 Now I'd like to ask you to think back to the beginning of 1994. At that time, which of the following appliances or devices did you have in use in your home?

	YES	NO	DK
a. A stand-alone freezer?	1	2	999
b. Two or more refrigerators?	1	2	999
c. An insulating wrap on your water heater?	1	2	999
d. Any compact fluorescent light bulbs?*	1	2	999
e. Any low-flow showerheads?	1	2	999
f. Any standard, non low-flow showerheads?	1	2	999

***[IF NEEDED: These are bulbs that screw into a standard light bulb socket, but are larger with a larger, heavier base, and use about 1/4 as much energy as a standard screw-in light bulb.]

CH. CHANGES SECTION

Complete CH1, CH2, CH3 for each row before going to next row.

CH1 I am going to read you a list of changes that may have occurred in your home that would affect energy use. After each, please tell me whether such a change occurred in the **past three years** (i.e., since the end of 1993).

CH2 FOR EACH 'YES', ASK: Approximately what month and year did that change occur?

CH3 Also ask follow-up before going to next item on list.

	CH1				CH2		CH3
	YES	**NO**	**DK**	**REF**	**Month**	**Year**	**Follow up**
a. Have you acquired a new refrigerator?	1	2	999	888	_____	_____	*
b. Have you acquired a new freezer?	1	2	999	888	_____	_____	*
c. [IF EC6 = 1, 2, or 3] Have you acquired a new central air conditioner, either as a replacement for an old unit or as an addition?	1	2	999	888	_____	_____	*
d. [IF EC6 = 4] Have you acquired a new room air conditioner?	1	2	999	888	_____	_____	*
e. Have you replaced any windows?	1	2	999	888	_____	_____	*
f. [IF EC19a = 'YES'] Have you unplugged a spare refrigerator, or discarded it without replacing it?	1	2	999	888	_____	_____	
g. [IF EC19b = 'YES'] Have you unplugged a freezer, or discarded it without replacing it?	1	2	999	888	_____	_____	
h. Have you replaced any major appliances other than a refrigerator, freezer, or air conditioner?	1	2	999	888	_____	_____	
i. Have you removed or stopped using any other major appliances, without replacing them?	1	2	999	888	_____	_____	
j. Have you installed any ceiling, floor, or wall insulation?	1	2	999	888	_____	_____	*
k. Have you turned down your hot water temperature?	1	2	999	888	_____	_____	*
l. Have you installed any low flow showerheads?	1	2	999	888	_____	_____	*
m. Have you reduced your hot water use in other ways?	1	2	999	888	_____	_____	
n. Have you installed a water heater wrap on your water heater?	1	2	999	888	_____	_____	

o. Have you installed any compact fluorescent light bulbs where you didn't have them before?	1	2	999	888	_____	_____	*
p. Has there been a change in the number of people living in your home at least 6 months out of the year?	1	2	999	888	_____	_____	*
q. Have you changed your main heating fuel?	1	2	999	888	_____	_____	*
r. [IF EC3=1] Have you changed your secondary heating fuel?	1	2	999	888	_____	_____	*
s. Have you changed your water heating fuel?	1	2	999	888	_____	_____	*
t. Have you changed the temperature you keep your home at during the winter?	1	2	999	888	_____	_____	*
u. [IF EC6=1, 2, or 3] Have you changed the temperature you keep your home at during the summer?	1	2	999	888	_____	_____	*
v. Have you added more living space to your home?	1	2	999	888	_____	_____	*

FOLLOW-UP QUESTIONS [ASK FOR EACH 'YES' TO CH1 THAT HAS A STAR ('*') IN THE FOLLOW-UP COLUMN]

a. Did you remove or stop using your old refrigerator at that time?

Yes 1
No 2
Don't Know 999

[GO TO CH1b]

b. [IF EC19a = YES or Don't Know] Did you remove or stop using your old freezer at that time?

Yes 1
No 2
Don't Know 999

[GO TO CH1c]

c. (1) Was this central air conditioner purchased to ...

Replace an existing system 1
Add a new system to your home (SKIP TO CH1c(3)) 2
Other (SPECIFY) (SKIP TO CH1c(3)) _____ 3
Don't know (SKIP TO CH1c(3)) 999

(2) Compared to the old unit, does the new air conditioner have more cooling capacity, less cooling capacity, or the same cooling capacity?

More capacity in new unit 1
Less capacity in new unit 2
Same 3
Don't know 999

(3) Was the new central air conditioner you installed a high efficiency model?

Yes 1
No 2
Don't know 999

(4) What is the new central air conditioner's Seasonal Energy Efficiency Rating (SEER)?

Rating ..... _____
Don't know 999

[GO TO CH1d]

d. (1) Was this room air conditioner purchased to ...

Replace an old unit 1
Add a new unit to your home (SKIP TO CH1d(3)) 2
Other (SPECIFY) (SKIP TO CH1d(3)) _____ 3
Don't know (SKIP TO CH1d(3)) 999

(2) Compared to the old unit, does the new air conditioner have more cooling capacity, less cooling capacity, or the same cooling capacity?

More capacity in new unit 1
Less capacity in new unit 2
Same 3
Don't know 999

(3) Was the new room air conditioner a high efficiency model?

Yes 1
No 2
Don't know 999

(4) What is the new room air conditioner's Seasonal Energy Efficiency Rating (SEER)?

Rating ..... _____
Don't know 999

[GO TO CH1e]

e. Were the new windows a high efficiency type?

Yes 1
No 2
Don't Know 999

[GO TO CH1f]

j. Which type of insulation was it? (CIRCLE ALL THAT APPLY)

Ceiling 1
Wall 2
Floor 3
Don't know 999

[GO TO CH1k]

k. Have you turned it back up since then?

Yes 1
No 2
Don't Know 999

[GO TO CH1l]

l. (1) How many did you add? (Don't know = 999) ..... _____
(2) How many are still in place? (Don't know = 999) ..... _____

[GO TO CH1m]

o. (1) How many did you add? (Don't Know = 999) ..... _____
(2) How many of these are still in place? (Don't Know = 999) ..... _____
(3) Since the installation of the compact fluorescent bulb(s), has your use of the lamps where these bulbs are installed increased, decreased, or remained the same?

Increased 1
Decreased 2
Remained the same 3
Don't know 999

(4) Since the installation of the compact fluorescent bulbs, has your use of the other lamps where these bulbs are NOT installed increased, decreased, or remained the same?

Increased 1
Decreased 2
Remained the same 3
Don't know 999

[GO TO CH1p]

p. (1) Did the number of people increase or decrease?

Increased 1
Decreased 2

(2) By how many people? ..... _____

[GO TO CH1q]

q. What was your main heating fuel before? IF GAS, PROBE: Is that natural gas from a utility, or is it bottled gas such as propane or LPG? DO NOT READ LIST. ACCEPT ONLY ONE RESPONSE.

Natural gas 1
Electric 2
Propane or bottled gas 3
Fuel oil 4
Wood, kerosene, or coal 5
Other (SPECIFY) _____ 6
Don't know 999

[GO TO CH1r]

r. What was your secondary heating fuel before? IF GAS, PROBE: Is that natural gas from a utility, or is it bottled gas such as propane or LPG? DO NOT READ LIST. ACCEPT ONLY ONE RESPONSE.

None 0
Natural gas 1
Electric 2
Propane or bottled gas 3
Fuel oil 4
Wood, kerosene, or coal 5
Other (SPECIFY)_____ 6
Don't know 999

[GO TO CH1s]

s. What was your water heating fuel before? IF GAS, PROBE: Is that natural gas from a utility or bottled gas such as propane or LPG? ACCEPT ONLY ONE RESPONSE.

Natural gas 1
Electricity 2
Propane, LPG, or bottled gas 3
Fuel Oil 4
Wood, kerosene, or coal 5
Other (SPECIFY) _____ 6
Don't know 999

[GO TO CH1t]

t. Is your new temperature setting warmer or colder than the old one?

Warmer 1
Colder 2
Don't know 999
By how many degrees F? ..... _____

[GO TO CH1u]

u. Is your new temperature setting warmer or colder than the old one?

Warmer 1
Colder..... 2
Don't know..... 999
By how many degrees F?..... _____

[GO TO CH1v]

v. How many square feet?..... _____

GO TO SECTION R (Rebate Program Participants), A (Audit Participants with no Rebates), HESL (HESL participants with no rebate or audit) or AM (Nonparticipants)

NONPARTICIPANTS SKIP TO SECTION AM.

QUESTIONS FOR 1994 REBATE PROGRAM PARTICIPANTS ONLY. [OTHERS SKIP TO SECTION AU]

[Questions R1 - R9 for Central Air Conditioner Rebate Participants Only]

Our records indicate that you received a rebate from PG&E in 1994 for a central air conditioner.

R1 Do you recall receiving a rebate for an air conditioner?

Yes 1
No 2
Don't know 999

R2 Prior to hearing of PG&E's rebate program, had you compared the energy efficiency of alternative air conditioners?

Yes 1
No 2
Don't know 999

R3 Prior to hearing of PG&E's rebate program, had you compared the prices of alternative air conditioners?

Yes 1
No 2
Don't know 999

R4 Prior to hearing of PG&E's rebate program, were you planning to buy an air conditioner at all?

Yes 1
No [SKIP TO R7] 2
Don't know 999

R5 Prior to hearing of PG&E's rebate program, were you planning to buy a model with the same cooling capacity, more capacity, or less capacity than the one you bought?

Same 1
More 2
Less 3
Don't know 999

R6 Prior to hearing of PG&E's rebate program, were you planning to buy a model with the same energy efficiency as the one you purchased with the program rebate, or one with a lower efficiency?

Lower 1
Same 2
Don't know 999

R7 If the rebate had not been available would you most likely have ....

- Paid the full price for the same efficient model without the rebate 1
- Purchased a less expensive standard efficiency model..... 2
- Not installed a new model 3
- Don't Know 999

R8 Have you installed your rebated air conditioner at this address?

- Yes [SKIP TO Insulation Rebate questions] 1
- No 2
- Don't know..... 999

R9 Why haven't you installed the rebated air conditioner at this address?

- Never got around to it..... 1
- Didn't need it 2
- Didn't know how 3
- Didn't think it would do much good 4
- Installed it at another address 5
- Other (Specify) _____ 6
- Don't Know 999

[Questions for Insulation Rebate Participants OTHERS SKIP TO SECTION AU]

Our records indicate you received a rebate from PG&E in 1994 for (ceiling/wall/floor) insulation.

R10 Do you recall receiving a rebate for insulation?

- Yes 1
- No..... 2
- Don't know..... 999

R11 Prior to hearing about PG&E's rebate program, were you planning to install insulation that year?

- Yes 1
- No (SKIP TO R13) 2
- Don't know (SKIP TO R13) 999

R12 At that time, had you asked for estimates for this work from a contractor or insulation supplier?

- Yes 1
- No..... 2
- Don't know..... 999

R13 If the rebate had not been available, would you most likely have...

Installed the same amount of insulation anyway, without a rebate, within one year . 1
Installed the same amount of insulation without a rebate more than one year later . 2
Not installed any additional insulation 3
Don't know..... 999

AU. QUESTIONS FOR AUDIT PROGRAM PARTICIPANTS ONLY [OTHERS SKIP TO SECTION HESL]

Our records indicated that you received an Energy Savings Plan Survey from PG&E during 1995.

MAIL AUDIT: You filled out a questionnaire about your home and appliances, then PG&E sent you a report with energy savings recommendations for your home.

ONSITE AUDIT: A PG&E inspector visited your home, recorded information about your appliances, and provided energy savings recommendations.

AU1 Do you recall having that survey done?

Yes 1
No (SKIP TO SECTION AM) 2
Don't know (SKIP TO SECTION AM) 999

COMPLETE EACH COLUMN FOR EACH MEASURE REPORTED ADOPTED AT Q CH1.	**IF CH1a = YES and CH1a Follow-up = YES**	**IF CH1b = YES and CH1b Follow-up = YES**	**IF CH1f or CH1g = YES**	**IF CH1j = YES**	**IF CH1m = YES**	**IF CH1n = YES**
	A. Replacing a Refrigerator	**B. Replacing a Freezer**	**C. Unplugging or discarding refrigerator/ freezer**	**D. Installing Low-Flow Showerheads**	**E. Installing Water Heater Wrap**	**F. Installing Compact Fluorescent Bulbs**
AU2 Did you do [energy efficiency measure] before or after you had the (mail/onsite) survey and recommendations from PG&E?	Before.....1 (Skip to next measure) After.....2 DK 999	Before.....1 (Skip to next measure) After.....2 DK 999	Before.....1 (Skip to next measure) After.....2 DK 999	Before .....1 (Skip to next measure) After .....2 DK 999	Before.....1 (Skip to next measure) After.....2 DK 999	Before .....1 (Skip to next measure) After .....2 DK 999
AU3 Prior to receiving the (mail/onsite) survey from PG&E, were you aware of the energy savings advantages of *[energy efficiency measure]*?	Yes .....1 No.....2 DK 999	Yes .....1 No.....2 DK 999	Yes .....1 No.....2 DK 999	Yes.....1 No .....2 DK 999	Yes .....1 No.....2 DK 999	Yes.....1 No .....2 DK 999
AU4 Prior to receiving the (mail/onsite) survey from PG&E, were you aware of the cost of *[energy efficiency measure]*?	Yes .....1 No.....2 DK 999	Yes .....1 No.....2 DK 999	Yes .....1 No.....2 DK 999	Yes.....1 No .....2 DK 999	Yes .....1 No.....2 DK 999	Yes.....1 No .....2 DK 999
AU5 Prior to receiving the (mail/onsite) survey from PG&E, were you planning on *[energy efficiency measure]*?	Yes .....1 No.....2 DK 999	Yes .....1 No.....2 DK 999	Yes .....1 No.....2 DK 999	Yes.....1 No .....2 DK 999	Yes .....1 No.....2 DK 999	Yes.....1 No .....2 DK 999
AU6 If you had not received the (mail/onsite) survey from PG&E, what would you most likely have done? *[energy efficiency measure]* at the same time as you did..... 1 *[energy efficiency measure]* within one year of when you did..... 2 *[energy efficiency measure]* more than a year later ..... 3 installed fewer *[energy efficiency measures]* ..... 4 not done *[energy efficiency measure]* at all ..... 5 Don't know ..... 999 [GO TO NEXT MEASURE OR SECTION HESL, IF NONE]	.....1 .....2 .....3 //////////////// 5 999	.....1 .....2 .....3 //////////////// 5 999	.....1 .....2 .....3 //////////////// 5 999	.....1 .....2 .....3 .....4 .....5 999	.....1 .....2 .....3 //////////////// 5 999	.....1 .....2 .....3 .....4 .....5 999

*If had more than one survey, was it before or after the earliest?

HESL. ASK FOR HESL PARTICIPANTS ONLY. OTHERS SKIP TO SECTION AM.

Our records indicate that PG&E assisted you with a loan for efficient (air conditioner/insulation/windows). PG&E provided a loan guarantee and helped you get a lower interest rate.

ASK HELS1-HESL17 FOR HESL AIR CONDITIONER PARTICIPANTS ONLY
HESL INSULATION PARTICIPANTS WITHOUT HESL AIR CONDITIONER SKIP TO HESL 18.
HESL WINDOW PARTICIPANTS WITHOUT HESL AIR CONDITIONER OR INSULATION SKIP TO HESL25.

HESL1 Do you recall receiving loan assistance from PG&E for an air conditioner?

Yes 1
No 2
Don't know 999

HESL2 How did you first hear about PG&E's loan program (ROTATE START)?

Air conditioning contractor or salesperson 1
Insert in bill from PG&E 2
PG&E's SEL phone line 3
Newspaper, magazine, radio, or TV ads 4
Friend or acquaintance 5
Other (specify)_____ 8
Don't Know 999

HESL3 Prior to hearing of the loan assistance program, were you planning to buy an air conditioner at all that year?

Yes 1
No [SKIP TO HESL11] 2
Don't know 999

HESL4 Prior to hearing of PG&E's loan assistance program, had you compared the <u>energy efficiency</u> of alternative air conditioners?

Yes 1
No 2
Don't know 999

HESL5 Prior to hearing of PG&E's loan assistance program, had you compared the <u>prices</u> of alternative air conditioners?

Yes 1
No 2
Don't know 999

HESL6 Prior to hearing of PG&E's loan assistance program were you planning to obtain a loan for the air conditioner?

Yes 1
No (GO TO HESL9) 2
Don't know 999

HESL7 Had you looked into financing options?

Yes 1
No 2
Don't know 999

HESL8 Why did you choose PG&E's HESL loan assistance? (ROTATE START - ACCEPT MULTIPLE RESPONSES)

Shorter processing time 1
Easy paperwork 2
PG&E certified the contractor 3
Thought I might not be approved for a different loan 4
Lower interest rate 5
Contractor suggested it 6
Already got turned down for a different loan 7
Other (Specify)_____ 8
Don't Know 999

HESL9 Prior to hearing of PG&E's loan assistance program, were you planning to buy an air conditioner of the same size, in tons, or one of more tons or less tons than the one you bought? (Higher tons means it can cool a bigger space.)

Same 1
More 2
Less 3
Don't know 999

HESL10 Prior to hearing of PG&E's loan assistance program, were you planning to buy an air conditioner with the same energy efficiency as the one you purchased with the program loan assistance, or one with a lower efficiency? (Higher efficiency means it uses less energy for the same amount of cooling.)

Lower 1
Same 2
Don't know 999

HESL11 Did your air conditioning contractor or salesperson explain the higher efficiency of the air conditioners that qualified for PG&E's loan assistance compared to other air conditioners?

Yes 1
No 2
Don't know 999

HESL12 At the time you made the decision to purchase this particiular air conditioner, did you understand this efficiency requirement for the loan assistance?

Yes 1
No 2
Don't know 999

HESL13 Did your contractor or salesperson explain the difference in price between the air conditioner that qualified for PG&E's loan assistance and other air conditioners?

Yes 1
No 2
Don't know 999

HESL14 At the time you made the decision to purchase this particular air conditioner, did you understand this price difference?

Yes 1
No 2
Don't know 999

HESL15 If the loan assistance from PG&E had not been available would you most likely have ....

Bought the same efficient air conditioner with a different loan, within one year 1
Bought the same efficient air conditioner without a loan, within one year..... 2
Purchased a less expensive standard efficiency air conditioner..... 3
Not installed a new air conditioner that year 4
Other (Specify)_____ 8
Don't Know..... 999

HESL16 Have you installed your new air conditioner at this address?

Yes [SKIP TO BOX INS]
No 2
Don't know 999

HESL17 Why haven't you installed the new air conditioner at this address?

Never got around to it 1
Didn't need it 2
Didn't know how..... 3
Didn't think it would do much good 4
Installed it at another address..... 5
Other (Specify)_____ 6
Don't Know..... 999

BOX INS
ASK HESL18-HESL25 FOR INSULATION PARTICIPANTS ONLY
HESL WINDOWS PARTICIPANTS WITHOUT INSULATION SKIP TO HESL26.
OTHERS SKIP TO SECTION AM

HESL18 Do you recall receiving loan assistance from PG&E for insulation?

- Yes 1
- No 2
- Don't know 999

HESL19 How did you first hear about PG&E's loan program (ROTATE START)?

- Insulation contractor or salesperson 1
- Insert in bill from PG&E 2
- PG&E's SEL phone line 3
- Newspaper, magazine, radio, or TV ads 4
- Friend or acquaintance 5
- Other (specify)_____ 8
- Don't Know 999

HESL20 Prior to hearing of the loan assistance program, were you planning to buy insulation at all that year?

- Yes 1
- No [SKIP TO HESL25] 2
- Don't know 999

HESL21 Prior to hearing of PG&E's loan assistance program, had you asked for estimates for this work from a contractor or insulation supplier?

- Yes 1
- No 2
- Don't know 999

HESL22 Prior to hearing of PG&E's loan assistance program were you planning to obtain a loan for the insulation?

- Yes 1
- No (GO TO HESL25) 2
- Don't know 999

HESL23 Had you looked into financing options?

- Yes 1
- No 2
- Don't know 999

HESL24 Why did you choose PG&E's HESL loan assistance? (ROTATE START - ACCEPT MULTIPLE RESPONSES)

- Shorter processing time 1
- Easy paperwork 2
- PG&E certified the contractor 3
- Thought I might not be approved for a different loan 4
- Lower interest rate 5
- Contractor suggested it 6
- Already got turned down for a different loan 7
- Other (Specify)_____ 8
- Don't Know 999

HESL25 If the loan assistance from PG&E had not been available, would you most likely have...

- Installed the same amount of insulation anyway, with a different loan within one year 1
- Installed the same amount of insulation anyway, without a loan, within one year 2
- Installed the same amount of insulation more than one year later 3
- Not installed any additional insulation 4
- Other (Specify)_____ 8
- Don't know 999

ASK HESL26-HESL38 FOR WINDOW HESL PARTICIPANTS ONLY - OTHERS SKIP TO SECTION AM

HESL26 Do you recall receiving loan assistance from PG&E for energy efficient windows?

- Yes 1
- No 2
- Don't know 999

HESL27 How did you first hear about PG&E's loan program (ROTATE START)?

- Windows contractor or salesperson 1
- Insert in bill from PG&E 2
- PG&E's SEL phone line 3
- Newspaper, magazine, radio, or TV ads 4
- Friend or acquaintance 5
- Other (specify) _____ 8
- Don't Know 999

HESL28 Prior to hearing of the loan assistance program, were you planning to buy new windows at all that year?

- Yes 1
- No [SKIP TO HESL34] 2
- Don't know 999

HESL29 Prior to hearing of PG&E's loan assistance program, were you planning to install the particular type of energy efficient windows you ended up installing with the loan assistance?

Yes 1
No 2
Don't know 999

HESL30 Prior to hearing of PG&E's loan assistance program, had you asked for estimates from a contractor or window supplier?

Yes 1
No 2
Don't know 999

HESL31 Prior to hearing of PG&E's loan assistance program were you planning to obtain a loan for the windows?

Yes 1
No (GO TO HESL34) 2
Don't know 999

HESL32 Had you looked into financing options?

Yes 1
No 2
Don't know 999

HESL33 Why did you choose PG&E's HESL loan assistance? (ROTATE START - ACCEPT MULTIPLE RESPONSES)

Shorter processing time 1
Easy paperwork 2
PG&E certified the contractor 3
Thought I might not be approved for a different loan 4
Lower interest rate 5
Contractor suggested it 6
Already got turned down for a different loan 7
Other (Specify)_____ 8
Don't Know 999

HESL34 Did your windows contractor or salesperson explain the higher efficiency for the windows that qualified for PG&E's loan assistance compared to other energy efficient windows?

Yes 1
No 2
Don't know 999

HESL35 At the time you made the decision to purchase these particular windows, did you understand this efficiency requirement for the loan assistance?

Yes 1
No 2
Don't know 999

HESL36 Did your contractor or salesperson explain the difference in price between the windows that qualified for PG&E's loan assistance and other energy efficient windows?

Yes 1
No 2
Don't know 999

HESL37 At the time you made the decision to purchase these particular windows, did you understand this price difference?

Yes 1
No 2
Don't know 999

HESL38 If the loan assistance from PG&E had not been available, would you most likely have...

Installed the same high efficiency windows with a different loan within one year? 1
Installed the same high efficiency windows without a loan within one year? 2
Installed lower efficiency windows? 3
Not installed any new windows that year? 4
Other (Specifiy) _____ 8
Don't know 999

AM. ATTITUDE MEASURES FOR USE IN MODEL SECTION

I'd like to ask a few questions about your general preferences and lifestyle. I will read a short series of statements. Using a scale of 1 to 5, where 5 means you strongly agree and 1 means you strongly disagree, please indicate to what extent you agree or disagree with these statements. [ROTATE START]

AM1 I make sure to compare the energy efficiency ratings of different models when I buy a major appliance such as an air conditioner, refrigerator, stove, water heater, clothes washer or dryer.

AM2 I recycle as much material as I can through programs in my community and at my workplace.

AM3 I spend much of my free time doing fix-up projects around the house.

AM4 I like to buy new kinds of home electronics products such as VCRs and compact disc players when they first come out.

AM5 I enjoy telling my friends about new kinds of products I have tried.

AM6 I am very particular about the way my home furnishings look.

AM7 On a scale of 1 to 5 where 1 is never and 5 is almost always, how often do you use coupons when you shop at the supermarket?

1 (never) 1
2 2
3 3
4 4
5 (almost always) 5
Don't Know 98

ANSWER GRID FOR AM1 - AM6

	AM1	AM2	AM3	AM4	AM5	AM6
Strongly disagree	1	1	1	1	1	1
	2	2	2	2	2	2
Neither agree nor disagree	3	3	3	3	3	3
	4	4	4	4	4	4
Strongly agree	5	5	5	5	5	5
Don't Know	99	99	99	99	99	99

1 2 3 4 5

D. DEMOGRAPHICS SECTION

These final questions are for comparison purposes only.

D1 Including yourself, how many people live in your home at least six months of the year?
- Number of persons..... _____

D2 How many of these persons are children under age 18?
- Number of persons..... _____
- Don't know..... 999
- Refused..... 888

D3 How many of these persons are over 65?
- Number of persons..... _____
- Don't know..... 999
- Refused..... 888

D4 What is your age, please?
- Under 18..... 1
- 18 - 25..... 2
- 26 - 35..... 3
- 36 - 45..... 4
- 46 - 55..... 5
- 56 - 65..... 6
- over 65..... 7
- Refused..... 888

D5 What is the highest level of education you have completed?
- Eighth grade or less..... 1
- Some high school..... 2
- Graduated high school..... 3
- Some college or technical school..... 4
- Graduated college or technical school..... 5
- Post graduate work..... 6
- Refused..... 888

D6. Which of the following categories best describes your total household income during 1995, before taxes?

- Less than $10,000 1
- $10,000 to under $20,000 2
- $20,000 to under $30,000 3
- $30,000 to under $40,000 4
- $40,000 to under $50,000 5
- $50,000 to under $75,000 6
- $75,000 to under $100,000 7
- Over $100,000 8
- Refused 888

D7 Record gender of respondent

- Male 1
- Female 2

D8 On a scale of zero to ten, with ten meaning a very favorable feeling and zero meaning a very unfavorable feeling, and five meaning not particularly favorable or unfavorable, I'd like you to rate your feelings towards PG&E.

- Record number ..... _____
- Don't know 999
- Refused 888

Those are all of my questions. Thank you very much for taking the time to participate in this study.

B

CADMAC PROTOCOLS TABLE 6

- Direct Assistance
- Energy Management Services

M&E PROTOCOLS TABLE 6
Energy Management Services Programs
Designated Unit of Measurement: Participants
ENDUSE: Total Program

1. Average Participant Group and Average Comaprison Group											
A. Pre-install usage:	Pre-install kW	na									
	Pre-install kWh	na									
	Pre-install Therms	na									
	Base kW	na									
	Base kWh	na									
	Base Therms	na									
	Base kW/ designated unit of measurement	na									
	Base kWh/ designated unit of measurement	na									
	Base Therms/ designated unit of measurement	na									
B. Impact year usage:	Impact Yr kW	na									
	Impact Yr kWh	na									
	Impact Yr Therms	na									
	Impact Yr kW/designated unit	na									
	Impact Yr kWh/designated unit	na		**5. A. 90% CONFIDENCE LEVEL**				**5. B. 80% CONFIDENCE LEVEL**			
	Impact Yr Therms/designated unit	na		**LOWER BOUND**	**UPPER BOUND**	**LOWER BOUND**	**UPPER BOUND**	**LOWER BOUND**	**UPPER BOUND**	**LOWER BOUND**	**UPPER BOUND**
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	na	1,419	na	na	585	2,253	na	na	769	2,069
	A. ii. Load Impacts - kWh	na	11,500,784	na	na	3,739,986	19,261,582	na	na	5,454,130	17,547,438
	A. iii. Load Impacts - Therms	na	792,653	na	na	-37,209	1,622,515	na	na	146,084	1,439,222
	B. i. Load Impacts/designated unit - kW	na	0.00843	na	na	0.00348	0.01339	na	na	0.00457	0.01229
	B. ii. Load Impacts/designated unit - kWh	na	68.3	na	na	22.2	114.5	na	na	32.4	104.3
	B. iii. Load Impacts/designated unit - Therms	na	4.71	na	na	-0.22	9.64	na	na	0.87	8.55
	C. i. a. % change in usage - Part Grp - kW	na	na	na	na	na	na	na	na	na	na
	C. i. b. % change in usage - Part Grp - kWh	na	na	na	na	na	na	na	na	na	na
	C. i. c. % change in usage - Part Grp - Therms	na	na	na	na	na	na	na	na	na	na
	C. ii. a. % change in usage - Comp Grp - kW	na	na	na	na	na	na	na	na	na	na
	C. ii. b. % change in usage - Comp Grp - kWh	na	na	na	na	na	na	na	na	na	na
	C. ii. c. % change in usage - Comp Grp - Therms	na	na	na	na	na	na	na	na	na	na
D. Realization Rate:	D.A. i. Load Impacts - kW, realization rate	na	0.405	na	na	0.167	0.644	na	na	0.220	0.591
	D.A. ii. Load Impacts - kWh, realization rate	na	0.594	na	na	0.193	0.995	na	na	0.282	0.906
	D.A. iii. Load Impacts - Therms, realization rate	na	0.460	na	na	-0.022	0.941	na	na	0.085	0.835
	D.B. i. Load Impacts/designated unit - kW, real rate	na	0.385	na	na	0.159	0.612	na	na	0.209	0.562
	D.B. ii. Load Impacts/designated unit - kWh, real rate	na	0.565	na	na	0.184	0.946	na	na	0.268	0.861
	D.B. iii. Load Impacts/designated unit - Therms, real rate	na	0.437	na	na	-0.021	0.895	na	na	0.081	0.794
3. Net-to-Gross Ratios		**RATIO**		**RATIO**	**RATIO**			**RATIO**	**RATIO**		
	A. i. Average Load Impacts - kW	na		na	na			na	na		
	A. ii. Average Load Impacts - kWh	na		na	na			na	na		
	A. iii. Average Load Impacts - Therms	na		na	na			na	na		
	B. i. Avg Load Impacts/designated unit of measurement - kW	na		na	na			na	na		
	B. ii. Avg Load Impacts/designated unit of measurement - kWh	na		na	na			na	na		
	B. iii. Avg Load Impacts/designated unit of measurement - Therms	na		na	na			na	na		
	C. i. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kW	na		na	na			na	na		
	C. ii. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kWh	na		na	na			na	na		
	C. iii. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - Thms	na		na	na			na	na		
4. Designated Unit Intermediate Data				**PART GRP**	**PART GRP**			**PART GRP**	**PART GRP**		
	A. Pre-install average value	na		na	na			na	na		
	B. Post-install average value	na		na	na			na	na		
6. Measure Count Data		**NUMBER**									
	A. Number of measures installed by participants in Part Group	168,295	Total Dwelling Units								
	B. Number of measures installed by all program participants in the 12 months of the program year	168,295									
	C. Number of measures installed by Comp Group	na									

7. Market Segment Data A. Distribution by CEC climate zone	**Zone**	**Percentage**
	1	5.34%
	2	8.62%
	3	17.62%
	4	49.69%
	5	12.29%
	6	0.69%
	7	5.28%
	8	0.19%
	9	0.01%
	10	0.28%

Revised

M&E PROTOCOLS TABLE 6
Direct Assistance Programs
Designated Unit of Measurement: Dwelling Unit
ENDUSE: Total Program

1. Average Participant Group and Average Comaprison Group											
A. Pre-install usage:	Pre-install kW	na									
	Pre-install kWh	na									
	Pre-install Therms	na									
	Base kW	na									
	Base kWh	na									
	Base Therms	na									
	Base kW/ designated unit of measurement	na									
	Base kWh/ designated unit of measurement	na									
	Base Therms/ designated unit of measurement	na									
B. Impact year usage:	Impact Yr kW	na									
	Impact Yr kWh	na									
	Impact Yr Therms	na									
	Impact Yr kW/designated unit	na									
	Impact Yr kWh/designated unit	na		**5. A. 90% CONFIDENCE LEVEL**				**5. B. 80% CONFIDENCE LEVEL**			
	Impact Yr Therms/designated unit	na		**LOWER BOUND**	**UPPER BOUND**	**LOWER BOUND**	**UPPER BOUND**	**LOWER BOUND**	**UPPER BOUND**	**LOWER BOUND**	**UPPER BOUND**
2. Average Net and Gross End Use Load Impacts		**AVG GROSS**	**AVG NET**	**AVG GROSS**	**AVG GROSS**	**AVG NET**	**AVG NET**	**AVG GROSS**	**AVG GROSS**	**AVG NET**	**AVG NET**
	A. i. Load Impacts - kW	2,079	2,079	1,963	2,196	1,963	2,196	1,988	2,170	1,988	2,170
	A. ii. Load Impacts - kWh	13,070,022	13,070,022	12,335,448	13,804,597	12,335,448	13,804,597	12,497,695	13,642,350	12,497,695	13,642,350
	A. iii. Load Impacts - Therms	692,274	692,274	615,752	768,796	615,752	768,796	632,654	751,894	632,654	751,894
	B. i. Load Impacts/designated unit - kW	0.0469	0.0469	0.0443	0.0495	0.0443	0.0495	0.0449	0.0490	0.0449	0.0490
	B. ii. Load Impacts/designated unit - kWh	295	295	278	311	278	311	282	308	282	308
	B. iii. Load Impacts/designated unit - Therms	16.5	16.5	13.9	17.3	13.9	17.3	14.3	17.0	14.3	17.0
	C. i. a. % change in usage - Part Grp - kW	na	na	na	na	na	na	na	na	na	na
	C. i. b. % change in usage - Part Grp - kWh	na	na	na	na	na	na	na	na	na	na
	C. i. c. % change in usage - Part Grp - Therms	na	na	na	na	na	na	na	na	na	na
	C. ii. a. % change in usage - Comp Grp - kW	na	na	na	na	na	na	na	na	na	na
	C. ii. b. % change in usage - Comp Grp - kWh	na	na	na	na	na	na	na	na	na	na
	C. ii. c. % change in usage - Comp Grp - Therms	na	na	na	na	na	na	na	na	na	na
D. Realization Rate:	D.A. i. Load Impacts - kW, realization rate	0.767	0.767	0.724	0.810	0.724	0.810	0.734	0.801	0.734	0.801
	D.A. ii. Load Impacts - kWh, realization rate	0.778	0.778	0.734	0.822	0.734	0.822	0.744	0.812	0.744	0.812
	D.A. iii. Load Impacts - Therms, realization rate	0.763	0.763	0.679	0.848	0.679	0.848	0.698	0.829	0.698	0.829
	D.B. i. Load Impacts/designated unit - kW, real rate	0.767	0.767	0.724	0.810	0.724	0.810	0.734	0.801	0.734	0.801
	D.B. ii. Load Impacts/designated unit - kWh, real rate	0.778	0.778	0.734	0.822	0.734	0.822	0.744	0.812	0.744	0.812
	D.B. iii. Load Impacts/designated unit - Therms, real rate	0.763	0.763	0.641	0.800	0.641	0.800	0.658	0.782	0.658	0.782
3. Net-to-Gross Ratios		**RATIO**		**RATIO**	**RATIO**			**RATIO**	**RATIO**		
	A. i. Average Load Impacts - kW	1.0		na	na			na	na		
	A. ii. Average Load Impacts - kWh	1.0		na	na			na	na		
	A. iii. Average Load Impacts - Therms	1.0		na	na			na	na		
	B. i. Avg Load Impacts/designated unit of measurement - kW	1.0		na	na			na	na		
	B. ii. Avg Load Impacts/designated unit of measurement - kWh	1.0		na	na			na	na		
	B. iii. Avg Load Impacts/designated unit of measurement - Therms	1.0		na	na			na	na		
	C. i. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kW	1.0		na	na			na	na		
	C. ii. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kWh	1.0		na	na			na	na		
	C. iii. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - Thms	1.0		na	na			na	na		
4. Designated Unit Intermediate Data				**PART GRP**	**PART GRP**			**PART GRP**	**PART GRP**		
	A. Pre-install average value	na		na	na			na	na		
	B. Post-install average value	na		na	na			na	na		
6. Measure Count Data		**NUMBER**									
	A. Number of measures installed by participants in Part Group	44,328	Total Number of Customers Served								
	B. Number of measures installed by all program participants in the 12 months of the program year	44,328									
	C. Number of measures installed by Comp Group	na									

7. Market Segment Data A. Distribution by CEC climate zone	**Zone**	**Percentage**
	1	5.35%
	2	7.97%
	3	16.72%
	4	46.29%
	5	12.02%
	6	6.90%
	7	4.72%
	8	0.01%
	9	0.00%
	10	0.03%

Revised