



**San Diego Gas & Electric
Marketing Programs & Planning
8306 Century Park Court
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1995 Direct Assistance Program

First Year Load Impact Evaluation

January 1997



**MPAP-95-P19-974-701
Study ID No. 974**



**San Diego Gas & Electric
Marketing Programs & Planning**

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Executive Summary

The Direct Assistance Program (DAP) is designed to help residential customers control energy costs by providing free weatherization, education, and appliance services. An outside consultant under contract to SDG&E is used to administer the program.

This first year load impact evaluation estimates the household gross energy savings by using a load impact regression model for participants who did **not** replace their refrigerators. The model allocates savings by space heating, space cooling, water heating, and miscellaneous end uses per dwelling, as defined in Table C-10 of the M&E Protocols. Additionally, savings for bringing refrigerators up to 1995 efficiency standards for customers are included. Table 1 below shows the annual savings for 1995 DAP participants.

End Use	Annual kWh Savings	Annual Therm Savings
Space Heating	-85	19
Space Cooling	-124	N/A
Water Heating	Insufficient Data	9 ¹
Refrigeration	65 ²	N/A
Miscellaneous	242	-13
Weighted TOTAL	98	6

Introduction

Program Overview

The 1995 Direct Assistance Program is designed to help low-income residential customers control energy costs by providing free weatherization, education, and appliance services. Communities targeted for program participation are those where a majority of the households are at or below income guidelines established for SDG&E's California Alternate Rates for Energy (CARE) Program. An outside consultant under contract to SDG&E is used to administer the program and provide in-home energy education, needs assessment, and installation of the needed "Big-Six" weatherization measures (ceiling insulation, caulking, weather-stripping, low-flow showerheads, water heater blankets, and minor structural repairs). Additional measures may be installed based upon the needs of the

¹ Gas water heating savings are attributed to the difference between household savings with gas water heaters less household savings without gas water heaters (both groups have gas space heating). Therefore, these savings are not included in the annual therm savings total to avoid double counting.

² Estimated savings from the 1995 DAP tracking database divided by the number of 1995 DAP participants (469,839 kWh / 7,268 participants).

residence. Examples of such measures are compact fluorescent light bulbs and gas furnace adjustment, repair, or replacement.

This first year load impact evaluation estimates the household gross energy savings for participants by using a load impact regression model. The regression analysis further breaks down savings by space heating, space cooling, water heating, and miscellaneous end uses as defined in Table C-10 of the M&E Protocols.

In addition to these end uses, a major savings component to DAP participants is refrigeration. The Direct Assistance Program takes credit for bringing refrigerators up to 1995 efficiency standards for the 822 DAP participants who replaced their refrigerators, while savings beyond the standards are accounted for in the Residential Appliance Efficiency Incentives - High-Efficiency Refrigeration Program. The savings for bringing refrigerators up to 1995 efficiency standards are calculated outside of the regression model. The methodology used to calculate the gross savings for refrigerators is specified in Table C-3B of the M&E Protocols.

The M&E Protocols do not require a comparison group for this program.

Sampling & Data Collection

Various sources of data were utilized in this analysis, including:

1. Customer name, address, appliance saturation, installed measures, and participation date from the program tracking database;
2. Electric and gas consumption history from the Customer Master File; and
3. Hourly weather data for three climate zones from the National Oceanic and Atmospheric Administration (NOAA) files.

Participant Sample - Load Impact Analysis

A census of the 7,268 participants in the 1995 Direct Assistance Program was attempted. Eliminating master metered accounts left 6,836 participants. After accounting for missing account numbers, 5,687 unique account numbers matched 5,499 historical billing records. This number was reduced to 2,414 potential participants due to the M&E Protocols billing history requirement of having 12 months of pre-installation data and 9 months of post installation data. Next, participants who also had their refrigerators replaced were dropped from the analysis (refrigerator savings are added back in later) and a verification for sufficient billing data lowered the analytical base to 1,885.

These 1,885 DAP participants were evaluated based on their household appliance ownership and what end use measures were installed at the site. For example, to be included in the electric space heating evaluation, the household needs to have electric space heating and an installed measure that would affect space heating. Also, a number of the participants are part of multi-family buildings where there is a central water heating system or a central heating system such that the energy consumption associated with that end use is not contained on that customer's consumption history; therefore, these participants need to be excluded from that part of the analysis.

Finally, data points that are considered to be outliers³ and participants with inestimable parameters (no regression output) are excluded from the analysis. Table 2 shows the final sample sizes of participants with household end uses that were affected by the installed measures used in the analysis.

Electric Household End Uses			Gas Household End Uses		
Space Heating	Space Cooling	Sample Size	Space Heating	Water Heating	Sample Size
Y	Y	48	Y	N	211
Y	N	280	Y	Y	623
N	Y	97	Y	N/A	462
TOTAL		425	TOTAL		1296

The Econometric Framework

The load impact analysis estimates the monthly savings for space heating, space cooling, and miscellaneous end uses. The estimated savings for the entire household is simply the sum of the space heating, space cooling, and miscellaneous end uses.

Electricity Model

The electricity consumption model was designed to take advantage of variations in weather over time (with months indexed by t), which allows the regression model to yield estimates of weather-related consumption for individual customers (indexed by i):

The Customer-Specific End Use Electricity Consumption Model

$$\begin{aligned} \text{kWh}_{it} = & \alpha_i + \theta_i t + \beta_i (\text{cdh}_{it}) + \gamma_i (\text{hdh}_{it}) \\ & + \Delta\alpha_i (d_{it}) + \Delta\beta_i (\text{cdh}_{it})(d_{it}) + \Delta\gamma_i (\text{hdh}_{it})(d_{it}) + \varepsilon_{it} \end{aligned}$$

The term $\alpha_i + \theta_i t$ is the non-weather-related trended element of the household electricity consumption, such as refrigeration and lighting. The next two terms, $\beta_i (\text{cdh}_{it})$ and $\gamma_i (\text{hdh}_{it})$, are the weather related kWh consumption based on cooling degree-hours (cdh_{it}) and heating degree-hours (hdh_{it}) respectively. The following three terms make up the estimated monthly savings associated with the DAP installation term d_{it} (a zero-one indicator variable): the miscellaneous end use is captured in the $\Delta\alpha_i (d_{it})$ term, the space cooling end use is estimated as $\Delta\beta_i (\text{cdh}_{it})(d_{it})$, and the space heating end use is defined as $\Delta\gamma_i (\text{hdh}_{it})(d_{it})$. The least-squares regression

³ See M&E Protocols Table 7 part D.1 at the end of this report for a complete description of outliers.

model also contains the usual random disturbance term ε_{it} . Final weather-normalized estimates are $\Delta\alpha_i$, $\Delta\beta_i$ (\overline{cdh}_i), and $\Delta\gamma_i$ (\overline{hdh}_i) based on the long-run averages of \overline{cdh}_i and \overline{hdh}_i .

Gas Model

The gas consumption model is identical to the electricity consumption model with the following two exceptions: (1) the left side of the equation is therms, not kWh, and (2) there are no cooling terms since that end use is associated with electricity only.

The Customer-Specific End Use Gas Consumption Model

$$\begin{aligned} \text{Therms}_{it} = & \alpha_i + \theta_i t + \gamma_i (\text{hdh}_{it}) \\ & + \Delta\alpha_i (d_{it}) + \Delta\gamma_i (\text{hdh}_{it})(d_{it}) + \varepsilon_{it} \end{aligned}$$

Results

Energy Savings Estimates

The savings estimates for the end uses space heating, space cooling, miscellaneous, and all measures combined are derived directly from the load impact regression analysis. The coefficients from the models represent the estimated monthly load impact associated with each end use (a negative coefficient represents a decrease in monthly consumption, while a positive coefficient represents an increase in monthly consumption). In Table 3, the monthly load impacts are converted into estimated annual savings, which are represented positively while energy increases are shown negatively. Electric water heating savings are ignored due to the small sample size of seven, although energy savings associated with electric water heating are captured in the miscellaneous portion of the model. Gas water heating savings are attributed to the difference between household savings with gas water heaters less household savings without gas water heaters (both groups have gas space heating). The refrigeration savings are derived from the project tracking system.

Capacity Savings Estimates

In order to estimate the capacity (kW) savings, the average annual kWh savings were divided by 8,760 (number of hours in a year) which is then divided by the coincident system peak load factor (ratio of average hourly consumption to demand coincident with system peak). SDG&E's 1995 estimated residential class system peak load factor was .5837. See M&E Protocols Table 6 parts 2.A and 2.B for estimated kW savings.

Summary of Results

The methodology described produced the following coefficients, t-statistics, and estimated annual savings for the 1995 Direct Assistance Program, as shown in Table 3 on the following page.

TABLE 3
1995 DAP EVALUATION

HOUSEHOLD CHARACTERISTICS			ESTIMATED MONTHLY COEFFICIENTS & T-STATISTICS										ESTIMATED ANNUAL kWh SAVINGS			
ELECTRIC	COOL	SAMPLE SIZE	SP HEAT	t STAT	COOL	t STAT	MISC	t STAT	TOTAL HH	t STAT	TOTAL HH	t STAT	SP HEAT	COOL	MISC	TOTAL HH
			Y	Y	48	28.65	2.15	21.86	2.14	-45.69	-1.86	4.82	0.58	-344	0.58	-344
Y	N	280	-2.72	-0.69	6.79	2.15	-9.13	-1.26	-5.06	-1.84	33	-1.84	33	-81	110	61
N	Y	97	24.72	3.08	15.01	2.39	-39.57	-2.68	0.16	0.03	-297	0.03	-297	-180	475	-2
TOTAL		425	7.09	2.01	10.37	3.73	-20.21	-3.12	-2.75	-1.12	-85	-1.12	-85	-124	242	33

HOUSEHOLD CHARACTERISTICS			ESTIMATED MONTHLY COEFFICIENTS & T-STATISTICS										EST. ANNUAL THERM SAVINGS			
GAS	WTR HEAT	SAMPLE SIZE	SP HEAT	t STAT	MISC	t STAT	TOTAL HH	t STAT	TOTAL HH	t STAT	SP HEAT	MISC	TOTAL HH	t STAT		
			Y	N	211	-1.82	-5.50	2.23	3.59	0.41	0.75	22	-27	-5	-5	-5
Y	Y	623	-1.86	-10.58	1.50	4.51	-0.36	-1.28	22	-18	4	4	4			
Y	NA	462	-1.04	-7.72	-0.06	-0.22	-1.10	-4.83	12	1	13	13	13			
TOTAL		1296	-1.56	-14.05	1.06	5.05	-0.50	-2.75	19	-13	6	6	6			

Gas Water Heating: (HH Savings with Gas Wtr Heaters) - (HH Savings without Gas Wtr Heaters)
 = -0.36 minus 0.41
 = -0.77 or 9.2 estimated annual therm savings for water heaters

REALIZATION RATES					
Program Savings from Load Impact Analysis (Household Savings of 33 kWh and 6 therms * 7,268 participants) [See Note 1]					
DAP '95 Refrigerator Savings from MIDAS database [See Note 2]					
TOTAL Household Savings Including Refrigerator Savings					
Program Savings from First Year Earnings Claim (DSM Annual Summary Technical Appendix, May 1996, p. TA 1-30)					
Realization Rate: load impacts estimated by study divided by first year earnings claim					
	kWh	kW	Therms		
	240,199	47	43,471		
	469,839	256			
	710,038	303	43,471		
	1,985,510	277	273,389		
	36%	109%	16%		

Note 1: Number of participants from Annual Summary of DSM Activities/May 1996, p. II-20.
 kW derived from Load Research DR rate Coincident with System Peak Load Factor of .5837 for 1995.

Note 2: Participants who replaced their refrigerators in the DAP were excluded from the load impact evaluation, so refrigerator savings need to be added to get total program impacts.
 Average savings of bringing 822 refrigerators up to 1995 efficiency standards are 572 kWh and .31 kW; savings are calculated per M&E Protocols Table C-3B, B.2 and B.3.
 For a complete description of the methodology used to calculate refrigerator savings, see SDG&E Study ID #914 (CADMAC Project ID # 2053R), by XENERGY, Feb. 1996.
 Number of refrigerators from Annual Summary of DSM Activities/May 1996, p. II-20.

M&E PROTOCOLS TABLE 6
RESULTS USED TO SUPPORT
PY95 SECOND EARNINGS CLAIM
FOR
DIRECT ASSISTANCE PROGRAM
FIRST YEAR LOAD IMPACT EVALUATION
JANUARY 1997
STUDY ID NO. 974

**SAN DIEGO GAS & ELECTRIC
M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY15 SECOND EARNINGS CLAIM FOR DIRECT ASSISTANCE PROGRAM
FIRST YEAR LOAD IMPACT EVALUATION, JANUARY 1997, STUDY ID NO. 974**

Designated Unit of Measurement: LOAD IMPACTS PER DWELLING UNIT
END USE: ALL END USES COMBINED

	5. A. 90% CONFIDENCE LEVEL				5. B. 80% CONFIDENCE LEVEL			
	LOWER BOUND	UPPER BOUND	PART GRP	COMP GRP	LOWER BOUND	UPPER BOUND	PART GRP	COMP GRP
1. Average Participant Group and Average Comparison Group								
A. Pre-install usage:								
Pre-install kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pre-install kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pre-install Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Base kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Base kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Base Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Base kW/designated unit of measurement	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Base kWh/designated unit of measurement	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Base Therms/designated unit of measurement	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Impact Yr kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Impact Yr kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Impact Yr Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Impact Yr kWh/designated unit	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Impact Yr Therms/designated unit	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2. Average Measured Gross End Use Load Impacts								
A. I. Load Impacts - kW	0.04	0.02	0.06	0.06	0.03	0.06	0.03	0.06
A. II. Load Impacts - kWh	97.7	146.4	146.4	146.4	95.8	135.6	95.8	135.6
A. III. Load Impacts - Therms	6.0	2.4	9.6	9.6	3.2	8.8	3.2	8.8
B. I. Load Impacts/designated unit - kW	0.04	0.02	0.06	0.06	0.03	0.06	0.03	0.06
B. II. Load Impacts/designated unit - kWh	97.7	146.4	146.4	146.4	95.8	135.6	95.8	135.6
B. III. Load Impacts/designated unit - Therms	6.0	2.4	9.6	9.6	3.2	8.8	3.2	8.8
C. I. e. % change in usage - Part Grp - kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C. I. b. % change in usage - Part Grp - kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C. I. c. % change in usage - Part Grp - Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C. II. a. % change in usage - Comp Grp - kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C. II. b. % change in usage - Comp Grp - kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C. II. c. % change in usage - Comp Grp - Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D. Realization Rate:								
D.A. I. Load Impacts - kW, realization rate	100%	55%	164%	164%	67%	152%	67%	152%
D.A. II. Load Impacts - kWh, realization rate	35%	18%	25%	25%	22%	50%	22%	50%
D.A. III. Load Impacts - Therms, realization rate	16%	6%	23%	23%	6%	23%	6%	23%
D.B. I. Load Impacts/designated unit - kW, real rate	100%	55%	164%	164%	67%	152%	67%	152%
D.B. II. Load Impacts/designated unit - kWh, real rate	35%	18%	25%	25%	22%	50%	22%	50%
D.B. III. Load Impacts/designated unit - Therms, real rate	16%	6%	23%	23%	6%	23%	6%	23%
3. Measured Gross Follow								
A. I. Average Load Impacts - kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A. II. Average Load Impacts - kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A. III. Average Load Impacts - Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B. I. Avg Load Impacts/designated unit of measurement - kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B. II. Avg Load Impacts/designated unit of measurement - kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B. III. Avg Load Impacts/designated unit of measurement - Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C. I. Avg Load Impacts based on % chg in usage in impact year relative to Base usage in impact year - kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C. II. Avg Load Impacts based on % chg in usage in impact year relative to Base usage in impact year - kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C. III. Avg Load Impacts based on % chg in usage in impact year relative to Base usage in impact year - Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4. Designated Unit Measurements Data								
A. Pre-install average value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B. Post-install average value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5. Measures Count Data								
A. Number of measures installed by participants in Part Group	11,337							
B. Number of measures installed by all program participants in the 12 months of the program year	43,375							
C. Number of measures installed by Comp Group	N/A							
7. Market Segment Data								
Number of Participants	5,307							

**M&E PROTOCOLS TABLE 7
DATA QUALITY AND PROCESSING
DOCUMENTATION**

FOR

**DIRECT ASSISTANCE PROGRAM
FIRST YEAR LOAD IMPACT EVALUATION**

JANUARY 1997

STUDY ID NO. 974

**M&E PROTOCOLS TABLE 7
 DATA QUALITY AND PROCESSING DOCUMENTATION
 For Direct Assistance Program
 First Year Load Impact Evaluation
 January 1997
 Study ID No. 974**

A. OVERVIEW INFORMATION

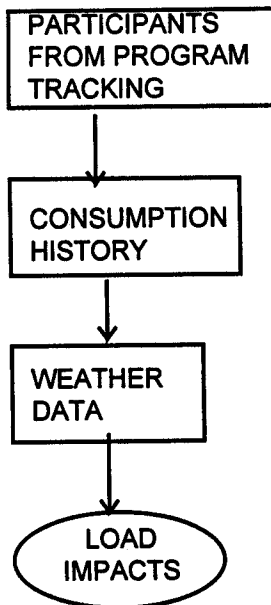
1. **Study Title and Study ID:** 1995 Direct Assistance Program: First Year Load Impact Evaluation, January 1997, MPAP-95-P19-974-701, Study ID No. 974
2. **Program, Program Year(s), and Program Description (Design):** Direct Assistance Program for the 1995 program year. The Program is designed to help low-income residential customers control energy costs by providing free weatherization, education, and appliance services.
3. **End Uses and/or Measures Covered:** All end uses combined disaggregated by space cooling, space heating, water heating, refrigeration, and miscellaneous.
4. **Methods and Models Used:** See the section of the report entitled The Econometric Framework on page 3 for a complete description of the final model specifications.
5. **Participant and Comparison Group Definition:** For the load impact analysis, the participants in the 1995 Direct Assistance Program are defined as having had at least one "Big 6" measure installed. The M&E Protocols do not require a comparison group for this program.
6. **Analysis sample size:**

ELECTRIC PARTICIPANT SAMPLE FOR 1995 DIRECT ASSISTANCE PROGRAM					
Space Heat	Space Cool	# of Customers	# of Installations	# of Measures	Avg. # of Months of Data
Y	Y	48	48	258	24.3
Y	N	280	280	1314	24.8
N	Y	97	97	587	24.4
TOTAL		425	425	2159	24.7
Refrigerators		822	822	822	N/A

GAS PARTICIPANT SAMPLE FOR 1995 DIRECT ASSISTANCE PROGRAM					
Space Heat	Water Heat	# of Customers	# of Installations	# of Measures	Avg. # of Months of Data
Y	N	211	211	1258	24.9
Y	Y	623	623	4409	24.8
Y	N/A	462	462	2689	24.3
TOTAL		1296	1296	8356	24.6

B. DATABASE MANAGEMENT

1. Flow Charts:



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

- Customer name, address, appliance saturation, installed measures, and participation date from the program tracking database. This is also the source for refrigerator savings.
- Electric and gas consumption history from the Customer Master File.
- Hourly weather data for three climate zones from NOAA files.

The data were merged together to form the dataset for the regression analysis leading to the estimated energy savings per dwelling unit. The savings are further disaggregated by space cooling, space heating, hot water heating, and miscellaneous end uses. The refrigerator savings were taken directly from the program tracking database; these savings are calculated per M&E Protocols Table C-3B, Sections B.2. and B.3.

3. Data Attrition:

a. Participant Sample - Load Impact Analysis

For the load impact analysis, the 7,268 participants in the 1995 Direct Assistance Program are defined as having had at least one "Big 6" measure installed in their home. After eliminating master metered accounts, 6,836 participants were left remaining in the potential analysis group. This group was lowered to 5,687 after eliminating participants with missing account numbers. 5,499 of these participants were successfully matched to their historical billing records. M&E Protocols require 12 months of pre-installation and 9 months of post-installation data. This requirement further reduced the analytical sample size down to 2,414 participants. Eliminating the participants who also had a refrigerator replaced, and double checking the required months of data (a miscode in the previous step did not eliminate participants with missing data) lowers the database to run the econometric model to 1,885 participants. Finally, after eliminating outliers (discussed later in section D.1.) and participants with inestimable parameters (no regression output) gives the sample sizes described previously in section A.6.

Number of Participants for Load Impact Analysis	
1995 DAP Participants	7,268
Single metered accounts (eliminate master metered accounts)	6,836
Participants with valid account numbers	5,687
Matched with historical billing file	5,499
Participants meeting minimum data requirements	2,414
Participants who did not replace refrigerators and met data requirements	1,885

b. Nonparticipant Sample - Load Impact Analysis

The M&E Protocols do not require a comparison group for the Direct Assistance Program.

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

5. All data collected for this analysis was utilized.

C. SAMPLING

1. **Sampling procedures and protocols:** A census of participants was attempted. See the section of the report entitled Participant Sample - Load Impact Analysis on page 2 and section B.3.a. of this Table 7 for a detailed description.
2. **Survey information:** A copy of the SDG&E Energy Team Home Survey is attached at the end of the report. Response rates for the participants was 100%.
3. **Statistical Descriptions:** See Table 3 on page 5 of the report.

D. DATA SCREENING AND ANALYSIS

1. **Outliers** were defined in a two-step process: first, how the estimated savings per household compared with the other household estimated savings, and second, how the individual household's data stream compared to itself. In the first step, any household savings estimate that was ± 4 standard deviations away from the mean household savings estimate was determined to be an outlier. In the second step, the intercept divided by the root mean square error for each individual household was used as a proxy for volatile data streams. For electric consumption, the outlier determination point was greater than 40% while for gas consumption, (much less volatility than electric consumption), the outlier determination point was 70%. Estimated household savings determined to be outliers were eliminated from the mean household savings and associated statistical calculations. The number of outliers is presented in the following table:

Number of Outliers and the Reason for Elimination		
	Electric	Gas
± 4 Standard Deviations	4	6
Intercept/RMSE Criteria (defined above)	8	15
Both	0	1
TOTAL	12	22
Number of Outliers as % of Possible Estimated Households	2.7%	1.7%

Missing Data Points: Only one variable with missing data was updated, the fuel type for water heating variable. If the residence was a single family dwelling and the residence had at least 100 therms of gas consumption in the year, and if the fuel type for water heating was missing, it was assumed to be gas. According to SDG&E's MIRACLE (residential saturation) surveys, this would be correct 98% of the time. 591 households had their missing water heating fuel updated

with gas. This step was done when the analytical sample frame was 2,414 potential sites (see part B.3.a.). It is not known how many of the households in the final dataset had their missing water heater fuel updated. Remaining missing data points were ignored in all calculations.

Weather Adjustments are described in the Econometric Framework section of the report on page 3.

2. A trend variable was included in the model to control for the effect of "background" variables.
3. See the section of the report entitled Participant Sample - Load Impact Analysis on pages 2-3 and parts B.3.a. and D.1. previously for data screening for inclusion in the final analysis dataset.
4. **Regression statistics:** see Table 3 on page 5 of the report for coefficients and t-statistics.
5. **Specification:**
 - a. The model is estimated entirely at the customer level (the extreme case of accounting for customer heterogeneity); the sources of variation are variation in weather over time and the date of the DAP installation.
 - b. The cooling degree-hour and heating degree-hour regressors are based on estimates of hourly temperature (which are, in turn, based on daily high and low temperatures). The base for the cooling degree-hour and heating degree-hour are 65 degrees Fahrenheit. Other time dependent regressors are a trend variable, installation date indicator variable, and interactions between degree hours and the indicator variable.
 - c. N/A
 - d. No factors were eliminated from the regression model as it was originally specified.
 - e. N/A
6. **Error in Measuring Variables:** A series of reasonability checks were run on survey data to verify fuel types and account for missing answers to the water heater fuel type. Billing data were screened for changes in occupancy.
7. **Autocorrelation:** Not Addressed.
8. **Heteroskedasticity:** Not Addressed.

9. **Collinearity:** With both cooling degree-hours and heating degree-hours in the model, it is likely that collinearity exists. However, since the goal is to estimate all end uses combined at the dwelling level, while the savings allocated to the end uses may be biased, the savings in the aggregate are reliable.
10. **Influential Data Points:** See part D.1. Outliers were eliminated from all calculations.
11. **Missing Data:** See part D.1. Remaining missing data points were ignored in all calculations.
12. **Precision:** The standard errors for the estimates were calculated from the variances of the samples of participants on the variable(s) in question.

E. DATA INTERPRETATION AND APPLICATION

1. **Calculation of Net Impacts:** Not required by the Protocols.
2. **Process, Choices Made, and Rationale:** Not required by the Protocols