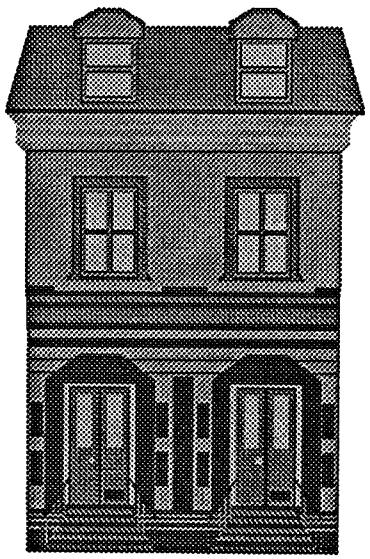
San Diego Gas & Electric
Marketing Programs & Planning
8306 Century Park Court
San Diego, California 92123

1996 Residential Weatherization Retrofit Incentives

First Year Load Impact Evaluation

March 1998



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San Diego Gas & Electric
Marketing Programs & Planning

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Executive Summary

The weatherization part of San Diego Gas & Electric's DSM Replacement Bidding Pilot falls under the CPUC Reporting Requirements Manual category of Residential Weatherization Retrofit Incentives (RWRI). This pilot was the result of the CPUC's goal to test the feasibility of DSM bidding. Under CPUC guidelines and requirements for the pilot, SDG&E contracted with SESCO, Inc., which offered free conservation improvements to selected homes. In 1996, SESCO provided comprehensive weatherization treatment to 3,909 homes. The measures installed, at no charge to the customer, included weatherstripping, caulking, low-flow showerheads, water heater and pipe wraps, compact fluorescent lamps, and ceiling insulation

Program savings estimates are summarized in Table 1 below:

Table 1
NET ANNUAL ELECTRIC AND GAS LOAD IMPACTS

	Whole House	Miscellaneous	Space Heating	Space Cooling
Kwh Savings	273.6	159.9	-37.2	150.9
Therm Savings	9.86	10.47	-0.74	N/A

Net savings of 273.6 kWh at the whole house level are significant (t = 6.16). These are comprised of significant cooling savings of 150.9 kWh (t = 1.92) and evidence of some miscellaneous savings of 159.5 kWh which are only significant at the 70% confidence level (t = 0.99). There is a small negative heating savings of -37.2 kWh which is statistically insignificant (t = -0.45). Miscellaneous savings may be due to the installation of high-efficiency compact fluorescent light bulbs. Approximately 6,400 of these bulbs were installed in participants' homes.

Estimated capacity savings at System Peak are 0.056 kW per household

There are significant whole house gas savings of 9.86 therms per year (t = 2.82), which are due almost entirely to significant miscellaneous savings of 10.47 therms (t = 1.79). As on the electric side, there is a small and statistically insignificant negative heating savings of -0.74 therms (t = -0.15). The miscellaneous savings are likely due to the installation of energy saving water heater measures such as water heater wraps, low-flow showerheads, faucet aerators, and reduced thermostat settings.

Program Overview

The weatherization part of San Diego Gas & Electric's DSM Replacement Bidding Pilot falls under the CPUC Reporting Requirements Manual category of Residential Weatherization Retrofit Incentives (RWRI). This pilot was the result of the CPUC's goal to test the feasibility of DSM bidding and was originally proposed in the 1993 General Rate Case. Under CPUC guidelines and requirements for the pilot, SDG&E contracted with SESCO, Inc. and Planergy in 1994 to conduct programs for existing residential customers. Planergy's program offered a $25 incentive to customers that turned in their operating secondary refrigerator or primary freezer for recycling. In 1996, Planergy removed and recycled a total of 2,473 refrigerators and 889 freezers. The SESCO program offered free conservation improvements to selected homes. In 1996, SESCO provided comprehensive weatherization treatment to 3,909 homes. The measures installed, at no charge to the customer, included weatherstripping, caulking, low-flow showerheads, water heater and pipe wraps, compact fluorescent lamps, and ceiling insulation

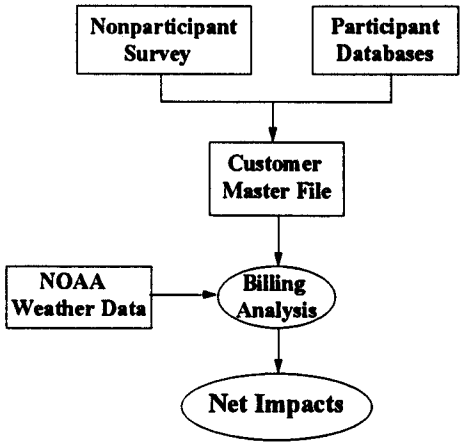
This report analyzes only the SESCO portion of the DSM Replacement Bidding Pilot.

Sampling & Data Collection

Data for the 1996 Residential WRI analysis were obtained from several major sources:

1. Participant name, address, account number, appliance saturation, demographics, participation date, and measures installed from the 1996 Residential WRI program tracking databases;
2. Nonparticipant name, address, account number, appliance saturation, demographics, and conservation activity from the nonparticipant survey (see Appendix A);
3. 1995-1997 electric and gas consumption history from SDG&E's Customer Master File; and
4. 1995-1997 hourly weather data for three climate zones from the National Oceanic and Atmospheric Administration (NOAA) files.

A data flow diagram is provided below:



A census of the 3,909 participants in the 1996 RWRI database was attempted. This number was reduced to 3,078 potential participants after matching to the Customer Master File, screening for installation dates in 1996, and screening for the M&E Protocols billing history requirement of 12 months of pre-installation data and 9 months of post-installation data. This included 2,111 households reporting electric heating and/or cooling and 2,175 households reporting gas heating (with or without cooling).

The original control group used by SESCO was deemed to be unsuitable for comparison purposes due to large differences in consumption levels between the participants and the control customers. The participant group was stratified on 1996 kWh level and a survey was conducted on a random group of 379 new nonparticipants based on this stratification. A total of 366 nonparticipants were available for comparison after matching to the Customer Master File and screening for sufficient pre- and post-installation data. Of these, 189 reported having electric heating and/or cooling and 253 reported gas heating.

The Econometric Framework

The load impact analysis estimates the monthly savings for space heating, space cooling, and miscellaneous end uses for those participants and nonparticipants who adopted energy saving measures or practices during 1996. For each individual customer, the estimated savings for the whole house is equal to the sum of the space heating, space cooling, and miscellaneous end-use savings. For the electric model, only customers reporting electric heating and/or cooling were included in the regression. For the gas model, only customers reporting gas heating (with or without cooling) were included.

Electricity Model

The electricity consumption model was designed to take advantage of variation 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

$$kWh_{it} = \alpha_i + \beta_i(cdh_{it}) + \gamma_i(hdh_{it}) + \Delta\alpha_i(d_{it}) + \Delta\beta_i(cdh_{it})(d_{it}) + \Delta\gamma_i(hdh_{it})(d_{it}) + \varepsilon_{it}$$

The two terms, $\beta_i(\mathrm{cdh}_{it})$ and $\gamma_i(\mathrm{hdh}_{it})$, 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 installation date 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 $\Delta\beta_i(cdh_{it})(d_{it})$, and the space heating end use is defined as $\Delta\gamma_i(hdh_{it})(d_{it})$. The least-squares regression 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 12-year 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, and (2) there are no space cooling terms since that end use is associated with electricity only.

The Customer Specific End Use Gas Consumption Model

$$Therms_{it} = \alpha_i + \gamma_i(hdh_{it}) + \Delta\alpha_i(d_{it}) + \Delta\gamma_i(hdh_{it})(d_{it}) + \varepsilon_{it}$$

For nonparticipants reporting adoption of conservation measures or practices, the reported date of adoption was used in the model. For nonparticipants who did not report adoption of such activities, an installation date of July 1, 1996, which is the average installation date for participants, was assumed for modeling purposes. The coefficients on the regression terms which deal with adoption activity should be zero for those nonparticipants who adopted nothing, and nonzero for nonparticipants who actually experienced some energy-changing activity.

In order to account for differences in demographics between the nonparticipant group and the participant group, participant gross impacts and net savings were normalized to the nonparticipant square footage and number in household.

Results

Energy Savings Estimates

The savings estimates for 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 (kWh) 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 Tables 2 and 3, the monthly gross load impacts are converted into annual estimates and normalized to the nonparticipant square footage and number in household. Estimated gross load impacts for participants are subtracted from those of nonparticipants to estimate net program savings.

The methodology described above produced the gross energy impacts and estimated net annual savings for the 1996 RWRI Program as shown in Tables 2 and 3 below:

Table 2
ANNUAL ELECTRIC IMPACTS AND SAVINGS

	Whole House	Miscellaneous	Space Heating	Space Cooling
Nonparticipants				
Count	189	189	71	156
Gross Impact	318.1	153.8	-67.9	232.2
Participants				
Count	2,111	2,111	534	1,901
Gross Impact	44.5	-6.1	-30.7	81.3
Net Savings	**273.6**	**159.9**	**-37.2**	**150.9**
T-Statistic	**6.16**	**0.99**	**-0.45**	**1.92**

Net savings of 273.1 kWh at the whole house level are significant (t = 6.16). These are comprised of significant cooling savings of 150.9 kWh (t = 1.92) and evidence of some miscellaneous savings of 159.9 kWh which are only significant at the 70% confidence level (t = 0.99). There is a small negative heating savings of -37.2 kWh which is statistically insignificant (t = -0.45). Miscellaneous savings may be due to the installation of high-efficiency compact fluorescent light bulbs. Approximately 6,400 of these bulbs were installed in participants' homes.

There may be a collinearity problem in the electric model since it contains terms for both heating degree hours and cooling degree hours. This may cause a misallocation of savings to the different end uses; however, the whole house savings are accurate.

Table 3
ANNUAL GAS IMPACTS AND SAVINGS

	Whole House	Miscellaneous	Space Heating
Nonparticipants			
Count	253	253	253
Gross Impact	9.12	1.32	7.68
Participants			
Count	2,175	2,175	2,175
Gross Impact	-0.74	-9.15	8.42
Net Savings	**9.86**	**10.47**	**-0.74**
T-Statistic	**2.91**	**1.86**	**-0.15**

There are significant whole house gas savings of 9.86 therms per year (t = 2.91), which are due almost entirely to significant miscellaneous savings of 10.47 therms (t = 1.86). As on the electric side, there is a small and statistically insignificant negative heating savings of -0.74 therms (t = -0.15). The miscellaneous savings are

likely due to the installation of energy-saving water heater measures such as water heater wraps, low-flow showerheads, faucet aerators, and reduced thermostat settings.

Capacity Savings Estimates

In order to estimate the capacity (kW) savings, the average annual cooling savings of 150.9 kWh were divided by 4,416 (number of hours in a the cooling months) which is then divided by the residential coincident system peak load factor (the ratio of average hourly consumption to demand coincident with system peak). SDG&E's 1996 estimated residential class system peak load factor from the 1996 Class Load Studies was 0.607. The estimated demand savings are therefore 0.056 kW per household.

Appendix B: M&E Protocols Table 6

RESULTS USED TO SUPPORT

PY96 SECOND EARNINGS CLAIM

FOR

RESIDENTIAL WEATHERIZATION RETROFIT INCENTIVES

FIRST YEAR LOAD IMPACT EVALUATION

MARCH 1998

STUDY ID NO. 989

SAN DIEGO GAS & ELECTRIC
M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY96 SECOND EARNINGS CLAIM FOR RESIDENTIAL WEATHERIZATION RETROFIT INCENTIVES PROGRAM
FIRST YEAR LOAD IMPACT EVALUATION, MARCH 1998, STUDY ID NO. 989

Designated Unit of Measurement: LOAD IMPACTS PER DWELLING UNIT
END USE: ELECTRIC AND GAS HEATING

				5. A. 90% CONFIDENCE LEVEL				5. B. 90% CONFIDENCE LEVEL			
				LOWER BOUND	UPPER BOUND	LOWER BOUND	UPPER BOUND	LOWER BOUND	UPPER BOUND	LOWER BOUND	UPPER BOUND
1. Average Participant Group and Average Comparison Group		PART GRP	COMP GRP	PART GRP	PART GRP	COMP GRP	COMP GRP	PART GRP	PART GRP	COMP GRP	COMP GRP
A. Pre-install usage:	A. i. Pre-install kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	A. ii. Pre-install kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	A. iii. Pre-install Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	A. iv. Base kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	A. v. Base kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	A. vi. Base Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	A. vii. Base kW/ designated unit of meesurement	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	A. viii. Base kWh/ designated unit of measurement	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	A. ix. Base Therms/ designated unit of measurement	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B. Impact year usage:	B. i. Impact Yr kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B. ii. Impact Yr kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B. iii. Impact Yr Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B. iv. Impact Yr kW/designated unit	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B. v. Impact Yr kWh/designated unit	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B. vi. Impact Yr Therms/designated unit	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2. Average Net and Gross End Use Load Impacts		AVG GROSS	AVG NET	AVG GROSS	AVG GROSS	AVG NET	AVG NET	AVG GROSS	AVG GROSS	AVG NET	AVG NET
A. Load impacts	A. i. Load Impacts - kW	0	0	0	0	0	0	0	0	0	0
	A. ii. Load Impacts - kWh	-30.7	-37.2	-88.5	27.1	-177.4	103.0	-75.7	14.3	-146.5	72.1
	A. iii. Load Impacts - Therms	8.42	-0.74	3.7	13.2	-9.3	7.8	4.7	12.1	-7.4	5.9
B. Load impacts/DUOM	B. i. Load Impacts/designated unit - kW	0	0	0	0	0	0	0	0	0	0
	B. ii. Load Impacts/designated unit - kWh	-30.7	-37.2	-88.5	27.1	-177.4	103.0	-75.7	14.3	-146.5	72.1
	B. iii. Load Impacts/designated unit - Therms	8.42	-0.74	3.7	13.2	-9.3	7.8	4.7	12.1	-7.4	5.9
C. % Change	C. i. a. % change in usage - Part Grp - kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C. i. b. % change in usage - Part Grp - kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C. i. c. % change in usage - Part Grp - Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C. ii. a. % change in usage - Comp Grp - kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C. ii. b. % change in usage - Comp Grp - kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	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	N/A	N/A
D. Realization Rate:	D.A. i. Load Impacts - kW, realization rate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	D.A. ii. Load Impacts - kWh, realization rate	0%	0%	0%	32%	0%	121%	0%	17%	0%	85%
	D.A. iii. Load Impacts - Therms, realization rate	27%	0%	12%	42%	0%	25%	15%	39%	0%	19%
	D.B. i. Load Impacts/designated unit - kW, real rate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	D.B. ii. Load Impacts/designated unit - kWh, real rate	0%	0%	0%	32%	0%	121%	0%	17%	0%	85%
	D.B. iii. Load Impacts/designated unit - Therms, real rate	27%	0%	12%	42%	0%	25%	15%	39%	0%	19%
3. Net-to-Gross Ratios		RATIO		RATIO	RATIO			RATIO	RATIO		
A. Load impacts	A. i. Average Load Impacts - kW	N/A		N/A	N/A			N/A	N/A		
	A. ii. Average Load Impacts - kWh	0.0		0.0	3.8			0.0	5.0		
	A. iii. Average Load Impacts - Therms	0.0		0.0	0.6			0.0	0.5		
B. Load impacts/DUOM	B. i. Avg Load Impacts/designated unit of measurement - kW	N/A		N/A	N/A			N/A	N/A		
	B. ii. Avg Load Impacts/designated unit of measurement - kWh	0.0		0.0	3.8			0.0	5.0		
	B. iii. Avg Load Impacts/designated unit of measurement - Therms	0.0		0.0	0.6			0.0	0.5		
C. % Change	C. i. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kW	N/A		N/A	N/A			N/A	N/A		
	C. ii. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kWh	N/A		N/A	N/A			N/A	N/A		
	C. iii. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - Thms	N/A		N/A	N/A			N/A	N/A		
4. Designated Unit Intermediate Data		PART GRP	COMP GRP	PART GRP	PART GRP	COMP GRP	COMP GRP	PART GRP	PART GRP	COMP GRP	COMP GRP
A. Pre-install averages	A. Pre-install average values										
	Square Footage	2,098	1,966	705	3,491	607	3,325	1,012	3,184	907	3,025
	Number in Household	3.10	2.90	0.62	5.58	0.53	5.27	1.16	5.04	1.05	4.75
B. Post-install averages	B. Post-install average values										
	Patricipant Square Footage	2,098	1,966	705	3,491	607	3,325	1,012	3,184	907	3,025
	Patricipant Number in Household	3.10	2.90	0.62	5.58	0.53	5.27	1.16	5.04	1.05	4.75
5. Measure Count Data		NUMBER									
A. Measures per participant	A. Number of measures installed by participants in Part Group — Electric	6,669									
	Gas	29,347									
B. Total measures	B. Number of measures installed by all program participants in the 12 months of the program year	52,936									
	C. Number of measures installed by Comp Group	Unknown									
7. Market Segment Data		CZone 7	CZone 16								
	Number of Participants — Electric	704	1409								
	Gas	762	1451								

Note 1: kW savings derived from 1996 Class Load Studies residential System peak load factor of 0.460.
Note 2: Ex-Ante estimated savings and participant count used in realization rates are taken from Advice Letter 957-E-A/986-G-A filed February 1, 1996.
Note 3: Calculated values for load factors and realization rates which are less than zero are set to zero.

SAN DIEGO GAS & ELECTRIC

M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY96 SECOND EARNINGS CLAIM FOR RESIDENTIAL WEATHERIZATION RETROFIT INCENTIVES PROGRAM

FIRST YEAR LOAD IMPACT EVALUATION, MARCH 1996, STUDY ID NO. 989

Designated Unit of Measurement: LOAD IMPACTS PER DWELLING UNIT
END USE: ELECTRIC COOLING

				5. A. 90% CONFIDENCE LEVEL				5. B. 90% CONFIDENCE LEVEL			
				LOWER BOUND	UPPER BOUND	LOWER BOUND	UPPER BOUND	LOWER BOUND	UPPER BOUND	LOWER BOUND	UPPER BOUND
1. Average Participant Group and Average Comparison Group		PART GRP	COMP GRP	PART GRP	PART GRP	COMP GRP	COMP GRP	PART GRP	PART GRP	COMP GRP	COMP GRP
A. Pre-install usage:	Pre-install kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pre-install kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pre-install Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base kW/ designated unit of measurement	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base kWh/ designated unit of measurement	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Base Therms/ designated unit of measurement	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B. Impact year usage:	Impact Yr kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Impact Yr kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Impact Yr Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Impact Yr kW/designated unit	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Impact Yr kWh/designated unit	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Impact Yr Therms/designated unit	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2. Average Net and Gross End Use Load Impacts		AVG GROSS	AVG NET	AVG GROSS	AVG GROSS	AVG NET	AVG NET	AVG GROSS	AVG GROSS	AVG NET	AVG NET
A. Load impacts	A. i. Load Impacts - kW	0.0303	0.0563	0.0102	0.0505	0.0071	0.1055	0.0146	0.0460	0.0179	0.0947
	A. ii. Load Impacts - kWh	81.3	150.9	27.3	135.3	18.9	282.9	39.2	123.4	48.1	253.7
	A. iii. Load Impacts - Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B. Load impacts/DUOM	B. i. Load Impacts/designated unit - kW	0.0303	0.0563	0.0102	0.0505	0.0071	0.1055	0.0146	0.0460	0.0179	0.0947
	B. ii. Load Impacts/designated unit - kWh	81.3	150.9	27.3	135.3	18.9	282.9	39.2	123.4	48.1	253.8
	B. iii. Load Impacts/designated unit - Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C. % Change	C. i. a. % change in usage - Part Grp - kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C. i. b. % change in usage - Part Grp - kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C. i. c. % change in usage - Part Grp - Therms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C. ii. a. % change in usage - Comp Grp - kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C. ii. b. % change in usage - Comp Grp - kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	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	N/A	N/A
D. Realization Rate:	D.A. i. Load Impacts - kW, realization rate	14%	26%	5%	23%	3%	48%	7%	21%	8%	43%
	D.A. ii. Load Impacts - kWh, realization rate	21%	39%	7%	35%	5%	73%	10%	32%	12%	66%
	D.A. iii. Load Impacts - Therms, realization rate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	D.B. i. Load Impacts/designated unit - kW, real rate	14%	26%	5%	23%	3%	48%	7%	21%	8%	43%
	D.B. ii. Load Impacts/designated unit - kWh, real rate	21%	39%	7%	35%	5%	73%	10%	32%	12%	66%
	D.B. iii. Load Impacts/designated unit - Therms, real rate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3. Net to Gross Ratios		RATIO		RATIO	RATIO			RATIO	RATIO		
A. Load impacts	A. i. Average Load Impacts - kW	1.9		0.7	2.1			1.2	2.1		
	A. ii. Average Load Impacts - kWh	1.9		0.7	2.1			1.2	2.1		
	A. iii. Average Load Impacts - Therms	N/A		N/A	N/A			N/A	N/A		
B. Load impacts/DUOM	B. i. Avg Load Impacts/designated unit of measurement - kW	1.9		0.7	2.1			1.2	2.1		
	B. ii. Avg Load Impacts/designated unit of measurement - kWh	1.9		0.7	2.1			1.2	2.1		
	B. iii. Avg Load Impacts/designated unit of measurement - Therms	N/A		N/A	N/A			N/A	N/A		
C. % Change	C. i. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kW	N/A		N/A	N/A			N/A	N/A		
	C. ii. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - kWh	N/A		N/A	N/A			N/A	N/A		
	C. iii. Avg Load Impacts based on % chg in usage in Impact year relative to Base usage in Impact year - Thms	N/A		N/A	N/A			N/A	N/A		
4. Designated Unit Intermediate Data		PART GRP	COMP GRP	PART GRP	PART GRP	COMP GRP	COMP GRP	PART GRP	PART GRP	COMP GRP	COMP GRP
A. Pre-install averages	A. Pre-install average values										
	Square Footage	2,096	1,966	705	3,491	607	3,325	1,012	3,184	907	3,025
	Number in Household	3.10	2.90	0.62	5.58	0.53	5.27	1.16	5.04	1.05	4.75
B. Post-install averages	B. Post-install average values										
	Patricipent Square Footage	2,098	1,966	705	3,491	607	3,325	1,012	3,184	907	3,025
	Patricipent Number in Household	3.10	2.90	0.62	5.58	0.53	5.27	1.16	5.04	1.05	4.75
5. Measure Count Data		NUMBER									
A. Measures per participant	A. Number of measures installed by participants in Part Group	24,066									
B. Total measures	B. Number of measures installed by all program participants in the 12 months of the program year	52,936									
	C. Number of measures installed by Comp Group	Unknown									
7. Market Segment Data		CZone 7	CZone 10								
	Number of Participants	704	1,409								

Note 1: kW savings derived from 1996 Class Load Studies residential System peak load factor of 0.460.

Note 2: Ex-Ante estimated savings and participant count used in realization rates are taken from Advice Letter 957-E-A/986-G-A filed February 1, 1996.

Note 3: Calculated values for load factors and realization rates which are less than zero are set to zero.

MEAS_DES	Frequency	Percent	Cumulative Frequency	Cumulative Percent
ADJUST STRIKER	13	0.2	13	0.2
CAULK DUCTS	52	0.8	65	1.0
CAULK WINDOW	429	6.4	494	7.4
DOOR SWEEPS	256	3.8	750	11.2
INS ATTIC HATCH	349	5.2	1099	16.5
INS OUTLETS	525	7.9	1624	24.4
INS PULLDOWN	5	0.1	1629	24.4
INS SWITCHES	527	7.9	2156	32.3
INSUL DUCTS	59	0.9	2215	33.2
INSULATE ATTIC	147	2.2	2362	35.4
INSULATE FLOOR	27	0.4	2389	35.8
INSULATE JOIST	111	1.7	2500	37.5
NEW THRESHOLD	18	0.3	2518	37.8
PULLEY PLUGS	4	0.1	2522	37.8
RPR W/H WRAP	175	2.6	2697	40.4
SASH LOCKS	15	0.2	2712	40.7
SEAL ATT HTCH	107	1.6	2819	42.3
SEAL BYPASSES	525	7.9	3344	50.1
SEAL EXHAUST	345	5.2	3689	55.3
SEAL EXT BB	376	5.6	4065	61.0
SEAL EXT DR	423	6.3	4488	67.3
SEAL INT BB	91	1.4	4579	68.7
SEAL SOLE PLATE	5	0.1	4584	68.7
W/S ATT ACS	372	5.6	4956	74.3
W/S EXT DOOR	660	9.9	5616	84.2
W/S INT DOOR	109	1.6	5725	85.8
W/S SLIDER	419	6.3	6144	92.1
W/S WINDOW	525	7.9	6669	100.0

MEAS_DES	Frequency	Percent	Cumulative Frequency	Cumulative Percent
ADJUST STRIKER	70	0.2	70	0.2
CAULK DUCTS	178	0.6	248	0.8
CAULK WINDOW	1542	5.3	1790	6.1
DOOR SWEEPS	1132	3.9	2922	10.0
INS ATTIC HATCH	1732	5.9	4654	15.9
INS OUTLETS	2444	8.3	7098	24.2
INS PULLDOWN	26	0.1	7124	24.3
INS SWITCHES	2445	8.3	9569	32.6
INSUL DUCTS	210	0.7	9779	33.3
INSULATE ATTIC	403	1.4	10182	34.7
INSULATE FLOOR	44	0.1	10226	34.8
INSULATE JOIST	309	1.1	10535	35.9
NEW THRESHOLD	118	0.4	10653	36.3
PULLEY PLUGS	31	0.1	10684	36.4
RPR W/H WRAP	761	2.6	11445	39.0
SASH LOCKS	63	0.2	11508	39.2
SEAL ATT HTCH	386	1.3	11894	40.5
SEAL BYPASSES	2441	8.3	14335	48.8
SEAL EXHAUST	1871	6.4	16206	55.2
SEAL EXT BB	1393	4.7	17599	60.0
SEAL EXT DR	1528	5.2	19127	65.2
SEAL INT BB	241	0.8	19368	66.0
SEAL INTBB	1	0.0	19369	66.0
SEAL SOLE PLATE	8	0.0	19377	66.0
SETBACK STAT	1	0.0	19378	66.0
W/S ATT ACS	1975	6.7	21353	72.8
W/S EXT DOOR	2849	9.7	24202	82.5
W/S INT DOOR	800	2.7	25002	85.2
W/S SLIDER	1930	6.6	26932	91.8
W/S WINDOW	2415	8.2	29347	100.0

MEAS_DES	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A/C COVER	125	0.5	125	0.5
CAULK DUCTS	219	0.9	344	1.4
CAULK WINDOW	1475	6.1	1819	7.6
DOOR SWEEPS	826	3.4	2645	11.0
INS ATTIC HATCH	1428	5.9	4073	16.9
INS OUTLETS	1876	7.8	5949	24.7
INS PULLDOWN	21	0.1	5970	24.8
INS SWITCHES	1877	7.8	7847	32.6
INSUL DUCTS	264	1.1	8111	33.7
INSULATE ATTIC	487	2.0	8598	35.7
INSULATE FLOOR	51	0.2	8649	35.9
INSULATE JOIST	297	1.2	8946	37.1
NEW THRESHOLD	80	0.3	9026	37.5
PULLEY PLUGS	16	0.1	9042	37.5
RPR W/H WRAP	603	2.5	9645	40.0
SASH LOCKS	45	0.2	9690	40.2
SEAL ATT HTCH	348	1.4	10038	41.7
SEAL BYPASSES	1875	7.8	11913	49.5
SEAL EXHAUST	1450	6.0	13363	55.5
SEAL EXT BB	1324	5.5	14687	61.0
SEAL EXT DR	1454	6.0	16141	67.0
SEAL INT BB	234	1.0	16375	68.0
SEAL INTBB	1	0.0	16376	68.0
SEAL SOLE PLATE	6	0.0	16382	68.0
SETBACK STAT	1	0.0	16383	68.0
W/S ATT ACS	1502	6.2	17885	74.3
W/S EXT DOOR	2200	9.1	20085	83.4
W/S INT DOOR	614	2.5	20699	85.9
W/S SLIDER	1527	6.3	22226	92.3
W/S WINDOW	1860	7.7	24086	100.0

MEAS_DES	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A/C COVER	147	0.3	147	0.3
ADJUST STRIKER	83	0.2	230	0.4
AERATORS	2708	5.1	2938	5.6
CAULK DUCTS	241	0.5	3179	6.0
CAULK WINDOW	2008	3.8	5187	9.8
DOOR SWEEPS	1412	2.7	6599	12.5
HI EFF MODULAR	3029	5.7	9628	18.2
INS ATTIC HATCH	2124	4.0	11752	22.2
INS CW PIPE	2378	4.5	14130	26.7
INS DUCTS	1	0.0	14131	26.7
INS HW PIPES	2390	4.5	16521	31.2
INS OUTLETS	3022	5.7	19543	36.9
INS PULLDOWN	32	0.1	19575	37.0
INS SWITCHES	3025	5.7	22600	42.7
INSUL DUCTS	282	0.5	22882	43.2
INSULATE ATTIC	564	1.1	23446	44.3
INSULATE FLOOR	72	0.1	23518	44.4
INSULATE JOIST	429	0.8	23947	45.2
NEW THRESHOLD	140	0.3	24087	45.5
OUTLET CAPS	2961	5.6	27048	51.1
PULLEY PLUGS	35	0.1	27083	51.2
RESET W/H	262	0.5	27345	51.7
RPR PIPE INS	100	0.2	27445	51.8
RPR W/H WRAP	943	1.8	28388	53.6
SASH LOCKS	80	0.2	28468	53.8
SEAL ATT HTCH	509	1.0	28977	54.7
SEAL BYPASSES	3019	5.7	31996	60.4
SEAL EXHAUST	2240	4.2	34236	64.7
SEAL EXT BB	1801	3.4	36037	68.1
SEAL EXT DR	1989	3.8	38026	71.8
SEAL INT BB	339	0.6	38365	72.5
SEAL INTBB	1	0.0	38366	72.5
SEAL SOLE PLATE	13	0.0	38379	72.5
SETBACK STAT	1	0.0	38380	72.5
SHOWER HEADS	2080	3.9	40460	76.4
W/S ATT ACS	2392	4.5	42852	81.0
W/S EXT DOOR	3572	6.7	46424	87.7
W/S INT DOOR	922	1.7	47346	89.4
W/S SLIDER	2386	4.5	49732	93.9
W/S WINDOW	2993	5.7	52725	99.6
WRAP W/H	211	0.4	52936	100.0

Appendix C: M&E Protocols Table 7

DATA QUALITY AND PROCESSING DOCUMENTATION

FOR

RESIDENTIAL WEATHERIZATION RETROFIT INCENTIVES
FIRST YEAR LOAD IMPACT EVALUATION

MARCH 1998

STUDY ID NO. 989

M&E PROTOCOLS TABLE 7
DATA QUALITY AND PROCESSING DOCUMENTATION
For Residential Weatherization Retrofit Incentives Program
First Year Load Impact Evaluation
March 1998
Study ID No. 989

A. OVERVIEW INFORMATION

1. **Study Title and Study ID:** 1996 Residential Weatherization Retrofit Incentives (RWRI) Program: First Year Load Impact Evaluation, MPAP-96-P97-989-802, Study ID No. 989, March 1998.

2. **Program, Program Year(s), and Program Description (Design):** Residential Weatherization Retrofit Incentives Program for the 1996 program year. The weatherization part of San Diego Gas & Electric's DSM Replacement Bidding Pilot falls under the CPUC Reporting Requirements Manual category of Residential Weatherization Retrofit Incentives. SESCO, Inc. provided weatherization treatment to selected customers including weatherstripping, caulking, low-flow showerheads, water heater and pipe wraps, compact fluorescent lamps, and ceiling insulation.

3. **End Uses and/or Measures Covered:** End uses are gas and electric space heating and combined electric heating and cooling. Measures include attic, wall, and/or duct insulation, weatherstripping, and caulking. Also installed were low-flow showerheads, water heater and pipe wraps and compact fluorescent lamps.

4. **Methods and Models Used:** The study uses a regression-based billing analysis to estimate net Program impacts. 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 are defined as customers selected and weatherized by SESCO during 1996. The comparison group is a stratified random sample from residential households who had complete 1996 consumption data.

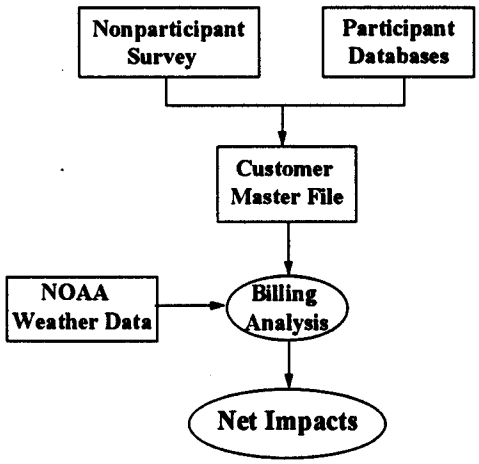
6. Analysis Sample Size:

ELECTRIC PARTICIPANT SAMPLE FOR 1996 RESIDENTIAL WRI				
	# of Customers	# of Installations	# of Measures	Avg. # of Months of Data
Space Heating	534	534	6,669	25.4
Space Cooling	1,901	1,901	24,086	25.4
Miscellaneous	2,111	2,111	10,913	25.4

GAS PARTICIPANT SAMPLE FOR 1996 RESIDENTIAL WRI				
	# of Customers	# of Installations	# of Measures	Avg. # of Months of Data
Space Heating	2,175	2,175	29,347	25.4
Miscellaneous	2,175	2,175	13,196	25.4

B. DATABASE MANAGEMENT

1. Flow Charts:



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

a. Participant name, address, account number, appliance saturation, demographics, participation date, and measures installed from the 1996 Residential WRI program tracking databases;

b. Nonparticipant name, address, account number, appliance saturation, demographics, and conservation activity from the nonparticipant survey;

c. 1995-1997 electric and gas consumption history from the Customer Master File; and

d. 1995-1997 hourly weather data for three climate zones from the National Oceanic and Atmospheric Administration (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 were further disaggregated by space cooling, space heating, and miscellaneous end uses.

3. Data Attrition:

a. Participant Sample - Load Impact Analysis

Number of Participants for Load Impact Analysis	
1996 RWRI participants initial database	3,909
Successful match with historical billing file	3,909
Participants meeting minimum pre/post data requirements	3,078
Eliminate participants with invalid regression output	3,078

b. Nonparticipant Sample - Load Impact Analysis

Number of Nonparticipants for Load Impact Analysis	
1995 MIRACLE XII nonparticipants	379
Successful match with historical billing file	379
Participants meeting minimum pre/post data requirements	366
Eliminate with invalid regression output	366

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 were utilized.

C. SAMPLING

1. **Sampling procedures and protocols:** A census of participants was attempted. See section B.3.a. of this Table 7 for a detailed description.

2. **Survey information:** A copy of the Nonparticipant Survey is included in Appendix A of the report. Participants were stratified on 1996 kWh level and a stratified random sample of nonparticipants was selected using this stratification.

3. **Statistical Descriptions:**

Participant and Nonparticipant Statistics					
	Count	**Square Footage**	**Number in Household**	**Average kWh/month**	**Average Therms/month**
Participants	3,078	2,098	3.10	717	40
Nonparticipants	366	1,966	2.90	617	37

D. DATA SCREENING AND ANALYSIS

1. No data points were eliminated as **outliers** or **influential** points.

   Missing Data Points: Customers for whom the energy type for heating was missing were eliminated. Individual months of missing consumption data were eliminated from the analysis.

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

2. See sections B.3.a. and D.1. of this Table 7 for data screening for inclusion in the final analysis dataset.

3. Regression statistics: see Table 6 of the report for coefficients and confidence intervals.

4. **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 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 an installation date indicator variable and interactions between degree-hours and the indicator variable.

c. Self-selection was not addressed.

d. No factors were eliminated from the regression model as it was originally specified.

e. The difference between pre-installation consumption and post-installation consumption is calculated directly from the regression equation, yielding gross impacts. Net impacts are defined as the difference in the gross impacts between participants and the comparison group.

6. **Error in Measuring Variables:** A series of reasonability checks were run on survey data to verify fuel types. 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 electric model, it is likely that collinearity exists. However, the savings in the aggregate should be reliable.

10. **Influential Data Points:** No Influential data points were eliminated from the calculations.

11. **Missing Data:** See part D.1

12. **Precision:** The standard errors for the estimates were calculated from the variances of the samples of participants and nonparticipants on the variable(s) in question.

E. DATA INTERPRETATION AND APPLICATION

1. **Calculation of Net Impacts** is specified by Section E. Item 1.a. of Table 7 of the M&E Protocols: the difference between participant impacts and nonparticipant impacts.

2. The **process** used in calculation of net impacts is that specified in Table 5 of the M&E Protocols.