

# **Final Report**

## **Measurement and Evaluation Study of the 2002 SDG&E Residential In- Home Audits Program**

### **Prepared for:**



San Diego Gas and Electric Company  
C/O Rob Rubin  
101 Ash Street, NMC16A  
San Diego, CA 92101

### **Prepared by:**

A handwritten signature in black ink, appearing to read "RLW ANALYTICS".

RLW Analytics, Inc.  
1055 Broadway Suite G  
Sonoma, CA 95476  
707-939-8823



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## **Executive Summary**

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This document is the final report for the Measurement and Evaluation Study of the 2002 SDG&E Local Residential In-Home Audits Program. This report contains an estimation of the proportion of program participants who have made physical modifications, behavioral modifications, or have participated in another SDG&E efficiency program since their audit. Additionally, this report contains measures of program effectiveness and participant satisfaction resulting from a process evaluation.

The SDG&E Local Residential In-Home Audits Program is an educational program that assists residential customers in understanding their energy usage, patterns of usage, and offers recommendations for energy savings, including referrals to other energy efficiency programs. The objectives of the audit are to provide detailed information on what the customer can do to become more energy efficient in their home including behavior and attitude modifications, to provide information to customers on how they can participate in rebate and incentive programs offered by SDG&E, and to encourage long-term energy savings. In 2002, according to the program tracking system, the program conducted an in-home energy audit at 1,199 residences.

The primary objectives of the study are to:

1. Determine whether or not participants have attempted to implement any of the energy efficient measures or ideas suggested by the auditor during the in-home visit, and
2. Determine whether or not participants have been convinced to participate in other energy efficiency programs offered by SDG&E.

The evaluation is based on telephone surveys with 100 program participants. We attempted to contact a total of 175 participants to complete 100 surveys, resulting in a conversion rate of 57.1%<sup>1</sup>. The survey responses have been statistically extrapolated to the program population.

### **Findings**

**Approximately 50% of program participants state they made physical modifications as a result of their energy audit.** The audit's physical recommendations appear to be appropriately targeted to the individual participants, as evidenced by the fact that ½ of participants have carried out a physical change as a result of their audit.

**Approximately 50% of program participants state they made behavioral modifications as a result of their energy audit.** This finding further reinforces the preceding finding that the audit recommendations are well thought out, and that there is a need for offering the audits to residential customers.

**Approximately 25% of program participants state they participated in other SDG&E energy efficiency programs since participating in the In-Home Audits Program.** This finding suggests that a sizable portion of program participants are understanding the information conveyed through the audit, evidenced by the fact not only do they understand that an equipment upgrade will result in energy savings, but they also seek out assistance in making that upgrade happen.

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<sup>1</sup> The conversion rate is defined as the ratio of successfully completed surveys to all attempted contacts.

***Observations and Recommendations***

Several observations were made about the 2002 Local Residential In-Home Audits Program through the course of conducting this evaluation. Some of these observations have resulted in recommendations for the program. Our major observations and recommendations are:

1. Audit Recommendations Are Being Implemented,
2. Program Tracking Data Excludes Participant Specific Recommendations, and
3. Provide Participants General Appliance-Specific Energy Usage Information.

Detailed specifics for each observation are articulated in the chapter entitled "Observations and Recommendations".

## **Introduction**

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This is the final report for the Measurement and Evaluation Study of the 2002 SDG&E Local Residential In-Home Audits Program. In this chapter, we will describe the 2002 program as well as our general evaluation approach.

### ***Program Overview***

The SDG&E Local Residential In-Home Audits Program is an educational program that assists residential customers in understanding their energy usage, patterns of usage, and offers recommendations for energy savings, including referrals to other energy efficiency programs. The objectives of the audit are to provide detailed information on what the customer can do to become more energy efficient in their home including behavior and attitude modifications, to provide information to customers on how they can participate in rebate and incentive programs offered by SDG&E, and to encourage long-term energy savings. In 2002, according to the program tracking system, the program conducted an in-home energy audit at 1,199 residences. According to the program tracking data, 1,008, or nearly 85%, of the participants of the 2002 program are homeowners.

### ***Evaluation Overview***

The primary objectives of the study are to:

1. Determine whether or not participants have attempted to implement any of the energy efficient measures or ideas suggested by the auditor during the in-home visit, and
2. Determine whether or not participants have been convinced to participate in other energy efficiency programs offered by SDG&E.

Using the SDG&E program tracking data as a sampling frame, we selected a sample of 100 participants for the telephone survey. All results were extrapolated to the program participant population.

We used a telephone survey to determine whether participants have made any physical or behavioral modifications as a result of their audit and whether participants have been convinced to participate in other energy efficiency programs offered by SDG&E. The survey also determined how participants heard of the program, reasons for participation, program satisfaction, and whether or not the participants felt there was value to the information and services provided.

The statistical analysis of the data primarily consisted of estimating the proportion of the proportion of participants who have made any physical or behavioral modifications as a result of their audit as well as estimating the proportion of participants have been convinced to participate in other energy efficiency programs offered by SDG&E. We also analyzed the responses to other components of the telephone survey, including reasons for not making any physical or behavioral modifications and participant satisfaction.

## **Results**

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### ***Participant Action Results***

Table 1 presents the incidence of participants installing new appliances or equipment or making other physical changes as a result of their energy audit. Fifty-four percent of participants state they have made physical changes as a result of their audit. At the 90% level of confidence, the relative precision of this estimate is  $\pm 14.5\%$ , yielding a 90% confidence interval of (46.2%, 61.8%).

	<b>% of Participants</b>
Yes	54%
No	46%

**Table 1: Incidence of Physical Changes Resulting From Audit**

All participants who stated they made physical changes as a result of their audit were asked to specify those changes. As shown in Table 2, 25% of all participants have converted existing lighting to CFLs and nearly 20% of all participants have replaced their refrigerator or freezer. Between 5% and 10% of all participants have installed a new thermostat, replaced their clothes washer and/or dryer, upgraded their windows or doors, replaced their dishwasher, or installed insulation or sealing measures.

	<b>% of Participants</b>
Converted Lighting to CFLs	25%
Replaced Refrigerator / Freezer	19%
Other	10%
Installed Insulation / Sealing Measures	9%
Replaced Washer / Dryer	8%
Upgraded Windows / Doors	7%
New Thermostat	6%
Replaced Dishwasher	6%
Removed Refrigerator / Freezer	4%
Replaced Stove	3%

**Table 2: Physical Changes Made As A Result of Energy Audit**

All participants who did not report making any physical changes as a result of their audit were asked why. Table 3 displays the results. Just over 25% of participants who haven't made any physical changes state the reason is because they have no money to make physical changes, with another 25% stating they don't believe the recommended changes would result in energy savings. Almost 20% of participants who did not make any physical changes say their audit report did not contain any recommended physical modifications.

	% of Participants Who Haven't Made Physical Changes
Financial Considerations / No Money	26%
Don't Believe Recommended Changes Would Result In Energy Savings	26%
Other	20%
My Audit Report Did Not Contain Any Recommended Physical Changes	17%
No Time	9%
Refused	2%

**Table 3: Reasons for Not Making Physical Changes**

Table 4 displays the incidence of participants planning to make future physical changes. About 40% of participants report they do have plans to install new appliances or equipment or make other physical changes in the near future. There was no difference between participants who have already made physical changes and those who have not.

	% of Participants
Yes	42%
No	57%
Don't Know	1%

**Table 4: Incidence of Plans to Make Future Physical Changes**

Table 5 presents the incidence of participants making behavioral changes as a result of their energy audit. Fifty-three percent of participants state they have made behavioral changes as a result of their audit. At the 90% level of confidence, the relative precision of this estimate is  $\pm 14.8\%$ , yielding a 90% confidence interval of (45.2%, 60.8%).

	% of Participants
Yes	53%
No	47%

**Table 5: Incidence of Behavioral Changes Resulting From Audit**

All participants who stated they made behavioral changes as a result of their audit were asked to specify those changes. As shown in Table 6, 31% of all participants are turning off unnecessary lights, and over 10% of all participants are limiting shower length, adjusting their thermostat settings, or doing laundry and dishes in the evening. Between 5% and 10% of all participants have unplugged unused appliances or are using fans instead of their air conditioner.

	% of Participants
Turn Off Unnecessary Lights	31%
Limit Shower Length	13%
Adjust Thermostat Settings	13%
Laundry & Dishes in Evening	11%
Use Fan Instead of Air Conditioner	8%
Unplug Unused Appliances	5%
Adjust Pool / Hot Tub Pump Settings	4%
Line-Dry Clothes When Possible	2%
Close Blinds / Curtains	1%

**Table 6: Behavioral Changes Made As A Result of Energy Audit**

All participants who did not report making any behavioral changes as a result of their audit were asked why. Table 7 displays the results. Thirty percent of all participants say those actions were already a common practice in their household, and nearly 10% don't believe that any behavioral modifications are needed. Three percent of participants say it is too difficult, they don't want to adjust their comfort level, or their children won't change their habits.

	% of Participants
Already A Common Practice	30%
I Don't Believe Behavioral Modifications Are Necessary	8%
It's Too Difficult / I Am Too Lazy	3%
Don't Want to Adjust Comfort Level	3%
Kids / Teenagers Won't Change Their Habits	3%

**Table 7: Reasons for Not Making Behavioral Changes**

Table 8 displays the incidence of participants planning to make future behavioral changes. About 40% of participants report they do have plans to make other behavioral changes in the near future. There was no difference between participants who have already made behavioral changes and those who have not.

	% of Participants
Yes	42%
No	57%
Don't Know	1%

**Table 8: Incidence of Plans to Make Future Behavioral Changes**

Table 9 displays the incidence of participants participating in other SDG&E energy efficiency programs. Twenty-four percent of participants state they have participated in other SDG&E program as a result of the information they received through the audit. At the 90% level of confidence, the relative precision of this estimate is  $\pm 28.0\%$ , yielding a 90% confidence interval of (17.3%, 30.7%).

	% of Participants
Yes	24%
No	76%

**Table 9: Incidence of Participating in Other SDG&E Programs**

Participants who have participated in other SDG&E energy efficiency programs were asked to specify the programs. Table 10 displays the results. Thirteen percent of all participants have participated in the Refrigerator-Freezer Recycling Program, eight percent have participated in the Smart Thermostat Program, and seven percent have participated in the Single-Family Home Improvement Rebates Program.

	% of Participants
Refrigerator-Freezer Recycling	13%
Smart Thermostat Program	8%
Single-Family Home Improvement Rebates	7%
Multi-Family Home Improvement Rebates	2%
Hard-to-Reach Lighting Program	2%

**Table 10: Other SDG&E Energy Efficiency Programs**

Table 11 summarizes the reasons for not participating in other SDG&E programs. Nearly 25% of participants who haven't participated in another program state this is so due to financial considerations, with another 33% of these participants reporting they haven't seen a program matching their needs. Only 5% of participants say it is because they weren't aware of the other programs.

	% of Participants Who Haven't Participated in Other Programs
I Haven't Seen A Program Matching My Needs	33%
Financial Considerations / No Money	24%
Missed Opportunity	11%
Other	11%
Not Interested Right Now	9%
No Time	7%
I Wasn't Aware of the Other Programs	5%
Don't Know	1%

**Table 11: Reasons for Not Participating In Other SDG&E Programs**

Table 12 presents the likelihood that participants will participate in another SDG&E energy efficiency program in the near future. Nearly 50% of participants state they are very likely to do so, with approximately another 10% stating they are likely. Only 5% of participants state they are not at all likely to participate in another SDG&E program in the near future.

	% of Participants
Not At All Likely	5%
Unlikely	12%
Not Sure	23%
Likely	13%
Very Likely	47%

**Table 12: Likelihood of Participating In SDG&E Energy Efficiency Program in Near Future**

**Satisfaction / Process Results**

Table 13 shows how participants first became aware of SDG&E's Residential In-Home Audits Program. Thirty percent of participants became aware of the program through a letter or mailing. Another 14% of participants learned of through the program because they called SDG&E to discuss either their bill or their meter. Almost 30% of participants do not know how they first became aware of the program.

	% of Participants
Letter or Mailing	30%
Don't Know	29%
I Called SDG&E About My Bill / My Meter	14%
Friend / Colleague	9%
Other	9%
Community Group or Organization	5%
SDG&E Website	2%
Light Bulb Turn-In Event	2%

**Table 13: Source of Awareness of Residential In-Home Audits Program**

Table 14 summarizes why participants chose to participate in the program. Nearly 50% of participants state their reason was to reduce their energy bill and save money. Fifteen percent of participants wanted to learn more about the energy characteristics of their homes, and another 18% wanted to evaluate the efficiency of their home.

	% of Participants
Reduce Energy Bill / Save Money	51%
Evaluate the Efficiency of My Home	18%
Learn More About Energy Characteristics of My Home	15%
Save Energy	8%
Other	3%
Environmental Concerns	2%
Don't Know	2%
Friend / Relative Advised Me To	1%

**Table 14: Primary Reason for Participating in Residential In-Home Audits Program**

Nearly 90% of participants are at least somewhat satisfied overall with the In-Home Audits Program, with nearly 70% stating they are very satisfied, as shown in Table 15. Only 3% of participants indicated they were unsatisfied.

	% of Participants
Very Unsatisfied	1%
Somewhat Unsatisfied	2%
Neither Satisfied Nor Unsatisfied	9%
Somewhat Satisfied	20%
Very Satisfied	68%

**Table 15: Overall Satisfaction with In-Home Audits Program**

Participants who were overall somewhat unsatisfied or very unsatisfied were asked why. Their verbatim responses are:

*"They provided good recommendations but my bill remains the same." (Somewhat Unsatisfied)*

*"The guy who did the audit came into our home, looked at our windows, gave us some CFL bulbs, and left. I felt the audit was not complete. I expected him to do a lot more." (Somewhat Unsatisfied)*

*"The auditor couldn't explain why our bills are so high in our new home with new appliances. Our average monthly bill is \$400.00, which is far too much for a new home." (Very Unsatisfied)*

All respondents were read a list of items about the In-Home Audits Program and asked to rate their satisfaction with each, using a scale of 1 to 5, where 1 means very unsatisfied and 5 means very satisfied. Table 16 displays the mean satisfaction rating and associated standard deviation for each item. The program is experiencing high levels of satisfaction among the participants, as the mean rating of each item is 4.39 or higher. Overall, participants are most satisfied with the convenience of scheduling the audit, followed by the quality and completeness of the energy inspection and the expertise level of the energy audit specialist. Participants are least satisfied with the practicality and usefulness of the audit recommendations and the clarity of the information on how to participate in other SDG&E energy efficiency programs. However, as evidenced by the high mean satisfaction ratings, the majority of participants are quite satisfied with even these aspects.

	Mean Rating	Standard Deviation
Convenience of Scheduling the Audit	4.80	0.50
Quality & Completeness of Energy Inspection	4.68	0.73
Review & Discussion of Audit Recommendations	4.64	0.66
Expertise Level of Energy Audit Specialist	4.68	0.74
Clarity & Ease of Understanding Energy Report	4.62	0.71
Completeness of Energy Report	4.58	0.80
Practicality & Usefulness of Audit Recommendations	4.45	0.95
Clarity of Info. On How to Participate in Other SDG&E Programs	4.39	0.84

**Table 16: Satisfaction with Various Aspects of the Program**

Table 17 summarizes the number of times participants have looked at or referred to their energy audit report. Thirty percent of participants have never looked at their energy report, and another 26% have only looked at the report once. Over 10% of participants have looked at their energy audit report 4 or more times.

	% of Participants
0	30%
1	26%
2	18%
3	14%
4	5%
6	4%
9	1%
12	1%
25	1%

**Table 17: Number of Times Looked At / Referred to Energy Report**

Participants were asked how much more they knew about how to save energy and manage their bill as a result of the audit. As shown in Table 18, 25% of participants state they know much more, and over 40% of participants say they know somewhat more. Just over 30% of participants say they know about the same as they did before the audit.

	<b>% of Participants</b>
I Know Much Less	0%
I Know Somewhat Less	1%
I Know About the Same	31%
I Know Somewhat More	42%
I Know Much More	25%
Don't Know	1%

**Table 18: Audit's Effect on Participant Knowledge On How to Save Energy & Manage Their Bill**

## **Observations and Recommendations**

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This chapter presents observations made about the 2002 Local Residential In-Home Audits Program through the course of conducting this evaluation. Recommendations to improve the program are also presented.

### ***Audit Recommendations Are Being Implemented***

Just over half of participants report they have made at least one physical change in their home as a result of their audit. Additionally, half of participants state they have made at least one behavioral modification based on the results of their energy audit. This suggests that for the most part participants found the audit recommendations reasonable and that they believed the recommendations could result in energy savings.

### ***Program Tracking Data Excludes Participant Specific Recommendations***

The specific physical and behavioral recommendations resulting from each participant's audit are not electronically recorded. So, the current evaluation of the program could only ask participants about what, if any, physical or behavioral changes they recall making as a result of their audit. Asking participants specifically about the actions recommended in their report would allow for a more accurate evaluation of program effectiveness. Therefore, we recommend electronically recording participant-specific recommendations based on the participant-specific energy reports.

SDG&E has indicated that starting with the 2004 program, the specific physical and behavioral recommendations for each participant will be recorded. The resulting costs, dollar savings, and energy savings will also be recorded under this new tracking system.

### ***Provide Participants General Appliance-Specific Energy Usage Information***

Approximately 25% of participants stated they didn't believe the recommended physical changes would result in energy savings. It might be useful if participants were provided a brochure or flyer that showed the average amount of energy consumed per hour (or year) for common home appliances of various ages (or other relevant categories). For example, the brochure could show the average annual consumption for refrigerators manufactured in 1985, 1990, etc. up to the present so that participants could estimate the amount of energy savings they could expect if they replaced their refrigerator. As another example, if the brochure showed the average hourly consumption of a computer, participants could estimate the energy savings resulting from turning their computer off when not in use. This would allow participants to anticipate the energy savings that would result from following the recommended actions.

SDG&E has indicated that in addition to the participant-specific energy report, each participant also receives a copy of the SDG&E Appliances brochure which details all appliances in the home and the energy usage associated with each.

## **EM&V Methodology**

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To estimate the proportion of participants that have made physical modifications, behavioral modifications, or have participated in another SDG&E efficiency program since their audit, RLW utilized telephone surveys with a statistically representative sample of program participants. We used the program tracking data to design a sample statistically representative of the program. For each program participant in the sample, we ascertained if they have made any physical or behavioral modifications or have participated in another SDG&E energy efficiency program since participating in the In-Home Audits program. The phone surveys also explored how participants first became aware of the program, reasons for participation, reasons for not making any physical or behavioral changes, reasons for not participating in other SDG&E energy efficiency programs, as well as participant satisfaction with various aspects of the program.

### ***Sample Design***

At the planning stage of the M&V evaluation for the Residential In-Home Audits Program, we proposed a sample of 100 participants for the telephone survey effort. The program tracking data basically consisted of the participant name, account number, and contact data. Therefore, we decided to use conventional simple random sampling to select the sample of 100 participants. In other words, each of the 1,199 program participants was equally likely to be included in the sample.

Our final sample consists of 100 participants. Since simple random sampling was utilized, the case weight of each participant is calculated as the population size divided by the sample size, or  $1,199/100 = 11.99$ .

### ***Telephone Survey Instrument Design***

We developed a questionnaire for the evaluation that obtained a variety of information including:

- How participants heard of the in-home audit program,
- The reasons for program participation,
- Whether the participant has attempted to implement any of the energy efficient measures or ideas suggested by the auditor during the in-home visit,
- If so, which measures or ideas have they implemented,
- Reasons for not implementing recommended measures or ideas,
- Whether the participant has been convinced to participate in other energy efficiency programs offered by SDG&E,
- If so, which programs they have participated in,
- Reasons for not participating in other energy efficiency programs offered by SDG&E, and
- Program satisfaction and recommended improvements.

The survey investigates how participants learned of the in-home audit program and what their specific motivations were for participating. The survey also determines whether or not the participant has made any behavioral changes such as turning off lights in unoccupied rooms or

lowering thermostat settings, or if they have made any physical changes such as replacing appliances or lights as a result of the audit. The survey also determines if the participant has participated in any other SDG&E rebate or incentive programs.

RLW submitted the survey instrument to the SDG&E project manager and other interested parties for a final review and ultimately approval.

### **Telephone Survey Data Collection**

Using the survey instrument described above, telephone surveys were conducted from RLW's CA office. All telephone surveyors were provided instruction on program operation, proper etiquette for contacting participants, and how to interpret participant responses.

All survey calls were tracked and any refusals or incomplete responses were recorded. Upon completing each interview, the telephone survey manager reviewed the survey for accuracy and completeness and then entered the data into an electronic database designed specifically for this survey by the project analyst.

Data were validated automatically using imbedded database functionality. The entered data were also continuously reviewed by the telephone survey manager. Prior to analysis, the project analyst thoroughly performed a quality control check on the data, identifying and correcting any illogical or unreasonable responses.

Table 19 presents the dispositions of the telephone survey data collection effort. We attempted to contact a total of 175 participants. Of these 175 participants, 100 completed a telephone survey, corresponding to conversion rate of 57.1%<sup>2</sup>.

	# of Participants
<b>Total</b>	<b>175</b>
Wrong Number	16
Refusal	11
No phone number/cannot locate #	9
Callback	8
Disconnected	8
Cannot remember program	6
Termination	4
Language Barrier	3
Claims no participation in program	2
Left Message	2
Participant recently passed away.	2
Signed Up But Did Not Attend	2
Busy	1
No Answer	1
<b>Completed</b>	<b>100</b>
<b>Conversion Rate</b>	<b>57.1%</b>

**Table 19: Telephone Survey Dispositions**

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<sup>2</sup> The conversion rate is defined as the ratio of successfully completed surveys to all attempted contacts.

### **Data Analysis**

Estimating the proportion of participants that have taken certain actions as a result of their audit is one of the primary objectives of this study. This is a straightforward application of estimating the parameter  $p$  in a Bernoulli probability distribution. Since there was no variable available for the entire population that might be related to whether the participant has taken the actions of interest, ratio estimation techniques are not possible. Therefore, conventional mean-per-unit estimation was used instead.

Under mean-per-unit estimation, the parameter  $p$  is estimated as  $\hat{p} = \frac{1}{N} \sum_{i=1}^n w_i * y_i$ , where  $N$  is

the population size,  $w_i$  is the case weight of sample participant  $i$ , and  $y_i$  is an indicator variable with a value of one if the participant has taken the action of interest and a value of zero otherwise. Taking into account the finite population correction factor, the associated error

bound at the 90% confidence level is then calculated as  $eb = 1.645 * \frac{\sqrt{\hat{p} * (1 - \hat{p})}}{\sqrt{n}} * \sqrt{1 - \frac{n}{N}}$ ,

where  $n$  is the sample size. The relative precision at the 90% confidence level is simply  $\hat{p}$  divided by the error bound,  $eb$ .

The project analyst also analyzed the remaining results of the telephone survey. The quantitative process survey analysis was carried out using SPSS, a commonly used statistical software package. RLW calculated weighted frequencies, and means of data, where appropriate, to provide unbiased estimates of population characteristics.