Final Report for the Evaluation of the California 2002 Home Energy Efficiency Survey Program

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1 Executive Summary

During PY 2002, Pacific Gas & Electric (PG&E), Southern California Edison (SCE), Southern California Gas Company (SoCalGas), and San Diego Gas & Electric (SDG&E) offered the Home Energy Efficiency Survey (HEES) Program. HEES was available statewide through both direct mail and the Internet. All residential customers living in individually-metered single and multi-unit dwelling units located in Investor Owned Utilities (IOUs) service territories were eligible to participate in the HEES Program.

1.1 Mail-In Audit

Mail-in surveys were available in English and Spanish in all four IOUs service territories, in Chinese in the PG&E, SCE, and SoCalGas service territories, and in Vietnamese in SDG&E's service territory. Mail-in surveys were distributed to consumers via direct mail marketing efforts outreach channels such as county and regional fairs and other major events using the Energy Efficiency Mobile Education Unit, and through customer requests.

1.2 Online Audit

For participants in the Online HEES, a simple log-on procedure allowed consumers to access the energy survey. Consumers input specific data regarding their energy use and received immediate results through an online energy report that provides an explanation of where energy dollars are spent. This easy-to-use tool provides customers with recommendations for immediate, short- and long-term changes that can make their homes more energy efficient.

While the Mail-In Audit was implemented statewide by Kema-Xenergy, each utility employed a different implementer for its Online Audit. Table 1-1 presents the breakdown of the Online Audits offered by the four utilities and their respective implementers.

Table 1-1
Online Audit Provided, by Utility, by Implementer

	Utility			
Implementer	**PG&E**	**SCE**	**SoCalGas**	**SDG&E**
Kema-Xenergy		X		
Nexus	X			
Enercom				X
SoCalGas			X	

1.3 Program Period

Originally, the definition of the program period for all audit types was understood to be April 1, 2002 through December 31, 2002. However, both SCE and PG&E defined their program periods for achieving their Mail-in Audit goals differently. SCE defined theirs as April 1, 2002 through March 31, 2003, while PG&E defined theirs as April 1, 2003 through February 28, 2003. Both

utilities explained that some of the participants in the first quarter of 2003 were responding to marketing efforts conducted in 2002.

1.4 Program Outreach

The utilities used a variety of strategies to inform customers of the Mail-In and Online audits. Utilities relied primarily on direct mail to reach customers with the Mail-in Audit, while they relied on a variety of techniques, including e-mail blasts, bill stuffers, and online ads, to inform customers of the Online Audit.

1.5 Evaluation Goals

Four evaluation goals, consistent with the requirements of the Energy Efficiency Policy Manual (CPUC, 2001) for information-only programs, were addressed as part of this evaluation.

1. Verify the number of residential energy audits completed under the PY2002 statewide program.

2. Evaluate program success by estimating the savings that can be attributed to the program based on a verification of audit-recommended measure implementation rates for both measures and practices. Two sub-objectives were pursued:

   a) Evaluate the success of the statewide Mail-in Audit by estimating the savings that can be attributed to the program based on a verification of audit-recommended measure implementation rates for both measures and practices.

   b) Evaluate the success of the SCE Online Audit by estimating the savings that can be attributed to the program based on a verification of audit-recommended measure implementation rates for both measures and practices.

3. Assess the impact of the HEES Program on customer awareness and knowledge of energy efficiency opportunities.

4. Provide ongoing feedback and corrective guidance regarding program design and implementation.

1.6 Methods

This study covers both the Mail-in and Online Audits and will include process evaluation, impact evaluation, and market assessment components. Sources of data used to achieve these four evaluation goals were:

- Available data from the various program-tracking databases
- Telephone interviews with 500 PY 2002 participants in the Mail-In and Online Audits
- In-depth interviews with program staff
- Available program documentation

While all necessary data was obtained to achieve these four goals for the Mail-In Audit, it was not always available for the four Online Audits. Table 1-2 presents the evaluation goals that were addressed given the available data. More details regarding data availability are provided in 2.6.

Table 1-2
Evaluation Objective, by Audit Type, by Utility

Audit Type	Utility	Verification of Completed Audits	Estimation of Savings	Assessment of Awareness & Knowledge	Provision of Constructive Feedback & Guidance
Mail-In	PG&E	X	X	X	X
	SCE	X	X	X	X
	SoCal Gas	X	X	X	X
	SDG&E	X	X	X	X
Online	PG&E	X			X
	SCE	X	X	X	X
	SoCal Gas				X
	SDG&E	X		X	X

1.7 Conclusions and Recommendations

The primary conclusions and recommendations of this evaluation are presented below.

1.7.1 Evaluability Assessment

Evaluability assessment is concerned with whether the available information associated with the implementation of a program will support the assessment of a program's performance. A related topic is the organization of the program-tracking databases and the quality of the database documentation. Both are discussed below.

1.7.1.1 Online Audit

The CPUC Energy Efficiency Policy Manual (EEPM) and the proposed California Evaluation Framework (CEF) (TecMarket Works, 2004) argue for a reasonably rigorous evaluation of information-only programs. Given the existing framework set forth in the EEPM and that proposed in the CEF, we recommend that the Online Audit should, at a minimum, collect enough reliable information from participants so that evaluators can interview them at a later date. In addition, information on the recommendations made to each participant along with the estimated savings for each recommendation should be retained in the program tracking database.

1.7.1.2 Database Documentation

PY 2002 was a year in which new software was implemented by the statewide vendor for the program tracking database for the IOUs' Mail-In Audit and the SCE Online Audit. We experienced serious delays in obtaining the necessary data, and the documentation required to assemble the necessary files for sampling and data collection was incomplete. It may be that

during PY 2003, many of these database problems were resolved. To verify that these problems were resolved, we recommend that this database be reviewed to determine its current ability to support an evaluation.

The documentation for Online Audit databases for SDG&E and PG&E were poorly organized, incomplete and contained little of the information required for an evaluation. Again, it may be that during PY 2003, many of the database problems were resolved. To verify that they were resolved, we recommend that these databases also be reviewed to determine their current ability to support an evaluation.

1.7.2 Marketing Effectiveness

Mail-In Audit acceptance or "take" rates for the four IOUs ranged from 8.5 percent to 11.5 percent. Participation in both the Mail-In Audit for the four IOUs and the Online Audit for the three IOUs covered most of their respective service territories. Efforts to reach the HTR populations based on ZIP code information, while successful, could be improved using 2000 Census data at a more refined level of detail. Finally, while not ignoring other HTR criteria, we recommend focusing on moderate income HTR participants since this population appears more likely to adopt recommended measures and practices.

1.7.3 Participant Satisfaction

Participants across all audit types are very satisfied with various aspects of the Mail-In and Online Audits, such as the amount of time required to complete the survey and relevance of the recommendations. The satisfaction of the non-HTR participants does not differ from the HTR participants.

1.7.4 Participant Attitudes and Awareness

Participant attitudes regarding energy efficiency are uniformly high. While the majority of participants were aware of the benefits of the measures and practices recommended in the audit and the ENERGY STAR® logo, less than 50 percent were aware of utility-sponsored energy efficiency programs and even fewer took advantage of the financial assistance offered by these programs.

1.7.5 Goal Attainment

First, based on our analysis using ZIP codes associated with the direct mail solicitations for the Mail-In Audit, we concluded that all four utilities met their goal of mailing at least 50 percent of their solicitations to the HTR customers. With respect to *completed* Mail-In Audits, PG&E and SCE exceeded both their targets *and* the numbers reported in their fourth quarter reports. To interpret the results for SoCalGas and SDG&E, note that both utilities defined their targets in terms of *audit surveys mailed* rather than audit surveys *completed*. According to this definition both utilities exceeded their targets.

Regarding the Online Audit, only SDG&E exceeded its target of 2,667. Both PG&E and SCE failed to meet their respective targets, underscoring the challenges in Internet marketing. Finally, while SoCalGas claimed in its fourth quarter report to complete 1,507 Online Audits (946 short

of its target), we could not verify this number since the SoCalGas did not provide the program-tracking database.

1.7.6 Adoption Ratios

The overall adoption ratios are reasonably high and consistent with past programs, ranging from 40 percent to 54 percent. Adoption ratios for the HTR population did not, in general, differ significantly from the non-HTR participants. However, when examining the moderate income HTR, the non-HTR participants tend to adopt measures, while the HTR participants tend to adopt practices.

1.7.7 Energy Savings

To the extent that we were able to examine engineering algorithms and their inputs that support the estimates of savings for recommended measures and practices, we concluded that, for the most part, they appear to be reasonable. The estimated energy savings for the statewide Mail-In Audit are 21,580,295 kWh and 1,323,793 therms. For the SCE Online Audit, the estimated kWh savings are 2,723,555. While these estimates are likely biased, both upward and downward, the average annual savings of 438 kWh per and 43.8 therms per household, while on the high end, are nevertheless in the plausible range. Moreover, that half of the adopted recommendations are measures as compared to practices, suggests that the HEES Program clearly produces energy savings that last much longer than two years, the current residential audit assumption regarding the duration of savings. This assumption should be modified to better reflect the lifecycle energy savings for residential audits.

1.7.8 Support of Resource Acquisition Programs

We attempted to determine whether the HEES Program serves as a "feeder" by funneling customers into resource acquisition programs such as the Residential Single- and Multi-Family Energy Efficiency Rebate Programs. From 39 percent to 76 percent of the respondents reported that the implementations cost money. However, the vast majority of the measure implementations were *not* funded by alternate sources of money such as utility and manufacturer rebates. While we agree that utilities have made reasonable efforts to inform all participants regarding the availability of rebates through various programs, these results suggest that utilities should explore additional strategies to inform participants.

2 Introduction

In the introduction, we describe the Home Energy Efficiency Services (HEES) Program as it was implemented during program year (PY) 2002, covering such topics as Mail-in versus Online Audits, program goals, customer eligibility, hard-to-reach customers, market barriers, languages addressed, funds expended, program outreach, and the definition of the program year.

2.1 Program Description

During PY 2002, Pacific Gas & Electric (PG&E), Southern California Edison (SCE), Southern California Gas Company (SoCalGas), and San Diego Gas & Electric (SDG&E) offered the Home Energy Efficiency Survey (HEES) Program. The HEES Program is available statewide through both direct mail and the Internet and provides residential customers with valuable information to assist them with understanding, controlling and reducing energy use in their homes.

The primary market barriers addressed by HEES are lack of consumer information and lack of high-efficiency products. HEES addresses these barriers by providing a comprehensive mix of information delivery channels, from direct mail audits to online information that ensure energy efficiency messages reach the widest possible audience, and by coordinating with the Statewide Marketing and Outreach Campaign to build general awareness, promote seasonal initiatives, and market appropriate energy efficiency measures.

2.1.1 Mail-In Audit

Mail-In surveys were available in English and Spanish in all four IOUs' service territories, in Chinese in PG&E, SoCalGas, and SCE service territories, and in Vietnamese in SDG&E's service territory. Mail-In surveys were distributed to consumers via direct mail marketing efforts, outreach channels such as county and regional fairs and other major events using the Energy Efficiency Mobile Education Unit, and through customer requests. Participating customers were given a survey and materials explaining the value of the program. Once completed, the surveys were mailed back to the statewide mail-in survey vendor for processing. Completed surveys were then analyzed against the customer's actual energy usage, and a report representing actual energy usage in graph form was mailed to the customer. Reports include information on energy efficiency products and services, rebate programs, and other energy-related information to encourage adoption of energy efficiency measures identified through the energy survey. For the Mail-In version of the HEES, consumers were selected from a database and sent a solicitation package. Customers who needed assistance with the survey or had additional questions could telephone the statewide vendor or their utility and have a trained energy specialist walk them through the HEES process. The Mail-In surveys for each of the four utilities and a sample report for each are presented in Appendix A.

2.1.2 Online Audit

For participants in the Online version of the HEES, a simple log-on procedure allowed consumers to access the energy survey. Consumers input specific data regarding their energy use and received immediate results through an online report that provides an explanation of where energy dollars are spent. This easy-to-use tool provides customers with immediate short- and long-term changes they can make to become more energy efficient. The Online surveys were available in English and

Spanish in all four IOUs' service territories, in Chinese in PG&E, SoCalGas, and SCE service territories, and in Vietnamese in SDG&E service territory. However, the Online Audits were interactive only in English. For other languages, web-posted versions (in PDF format) could be downloaded from the utility websites, completed, and returned to the utility for processing.

While the Mail-In survey was implemented statewide by Kema-Xenergy using the RECAP software, each utility employed a different implementer for its Online Audit. Table 2-1 presents the breakdown of the Online Audits offered by the four utilities and their respective implementers.

Table 2-1
Online Audit Provided, by Utility, by Implementer

	Utility			
Implementer	**PG&E**	**SCE**	**SoCalGas**	**SDG&E**
Kema-Xenergy		X		
Nexus	X			
Enercom				X
SoCalGas			X	

The Online Audits vary in terms of the basic data collected from participants and the types and number of measures and practices that could be recommended. Internet images (screen captures) of the Online surveys and sample reports are presented for SCE, PG&E, and SDG&E in Appendices B, C, and D, respectively. The sample Online Audit for SoCalGas is presented in Appendix E (Note: a sample report for SoCalGas was not available).

Table 2-2 and Table 2-5 present the targets for each utility, the number of audits reported in the utility fourth-quarter reports, and our estimates of verified completed audits for each utility. Note that both SDG&E and SoCalGas have defined their goal for the Mail-in Audit in terms of the number of Mail-in Audit surveys *sent* to customers, rather than the number of Mail-in Audit surveys *completed* by customers.

The various databases upon which our verification of completed audits was based are presented in Table 2-2.

Table 2-2
Mail-in Audit Goals, by Utility

Utility	Target
PG&E	18,000
SCE	18,000
SoCalGas	3,000
SDG&E	4,000
Total	43,000

During PY 2002, a special effort was made to reach hard-to-reach (HTR) customers. The utilities used the HTR definition developed by the California Public Utilities Commission (CPUC). This definition was based on the following five attributes:

1. Language: Primary spoken language is other than English
2. Income: Those customers who fall into the moderate income level
3. Housing Type: Multi-family and mobile home tenants
4. Geography: Residents of areas other than the San Francisco Bay area, San Diego area, Los Angeles Basin, or Sacramento
5. Tenure: Renters

While the definitions of renter and spoken language other than English are fairly obvious, we provide definitions for "rural" and "moderate income" that are perhaps less obvious.

As Reed (2001) noted, the problem with the traditional definition of rural is that there are areas within metropolitan counties that are more like non-metropolitan areas and are economically and socially isolated from central areas. Even though such areas may be "rural" in character they are defined as urban because they are located within a metropolitan area. Reed points out that to remedy this problem, Goldsmith[1] has introduced additional criteria that can be used to identify the "rural" portions of metropolitan counties. The problem arises mostly in large metropolitan counties where it is physically possible to have areas that are socially and economically isolated from central areas. Large metropolitan counties are defined as counties with at least 1,225 square miles, roughly an area 30 by 40 miles. Within these counties, small areas are classified as open-country or rural neighborhoods or small towns, if 1) there are no persons who are living in a city of 50,000 or more persons or in the surrounding densely settled suburbs, or 2) in cities of 25,000 or more persons. These "rural" areas are then assessed with respect to whether or not they are economically linked to central areas. This is determined by whether 15 percent or less of the work force in these areas commute to work in central areas. If less than 15 percent of the work force commutes, these portions of large metropolitan counties are considered rural isolated areas.

Table 2-3 presents the operational definition of moderate income.

[1] Goldsmith, Harold F., Dena S. Puskin, and Dianne J. Stiles, *Improving the Operational Definition of "Rural Areas" for Federal Programs*, Washington, D. C.: U. S. Department of Health and Human Services, Health Resources and Service Administration, 1993. (http://www.nal.usda.gov/orhp/Goldsmith.htm).

Table 2-3
Operational Definition of Moderate Income

	Moderate-Income	
Size of Family Unit	Lower Limit	Upper Limit
1	$ 12,525	$ 33,400
2	$ 16,875	$ 45,000
3	$ 21,225	$ 56,600
4	$ 25,575	$ 68,200
5	$ 29,925	$ 79,800
6	$ 34,275	$ 91,400
7	$ 38,625	$ 103,000
8	$ 42,975	$ 114,600
9	$ 47,325	$ 126,200
10	$ 51,675	$ 137,800
11	$ 56,025	$ 149,400
12	$ 60,375	$ 161,000
13	$ 64,725	$ 172,600

In Decision 02-03-056, the CPUC required that 50 percent of the Mail-In survey targets will be sent to HTR customers. Per the draft decision, a target was established such that at least 50 percent of the utility direct mail solicitations would be sent to HTR customers, as defined by the CPUC. The total number of solicitations mailed by each utility in PY 2002 is presented in Table 2-4.

Table 2-4
Direct Mail Solicitations in PY 2002, by Utility

Utility	Direct Mail Solicitations
PG&E	219,880
SCE	264,853
SoCalGas	56,576
SDG&E	18,453
Total	559,762

In their respective 4th Quarter Reports, all four utilities claimed to have met their HTR direct mail solicitation targets. We conducted an analysis of the utility mailings to examine these claims.

Each utility also had targets for their Online Audits. Table 2-5 presents the Online Audit goals for each utility.

Table 2-5
Online Audit Goals, by Utility

Utility	Target
PG&E	12,000
SCE	12,000
SoCal Gas	2,000
SDG&E	2,667
Total	28,667

2.2 Program Expenditures

The final PY 2002 expenditures for the HEES Program are presented in Table 2-6 for each utility.

Table 2-6
PY 2002 Expenditures for the HEES Program, by Utility

	PGE	SCE	SoCalGas	SDGE
Budgeted	$700,000	$830,000	$250,000	$234,000
Expended	$446,802	$799,147	$227,793	$261,013

SCE expended the largest amount, at least partly due to additional funds required to implement an online marketing campaign to increase customer participation in the Online survey, with SoCalGas expending the least. In all, the four IOUs combined to spend $1,734,755 in PY 2002.

2.3 Program Period

Originally, the definition of the program period for all audit types was understood to be April 1, 2002 through December 31, 2002. However, both SCE and PG&E defined their program periods for achieving their Mail-in Audit goals differently. SCE defined theirs as April 1, 2002 through March 31, 2003, while PG&E defined theirs as April 1, 2002 through February 28, 2003. The arguments of both utilities are based on the impact of marketing efforts conducted in 2002 on customer behavior in the first quarter of 2003.

SCE's arguments for including these participants in the first quarter of 2003 are that they were responding to SCE's marketing campaigns conducted in 2002. In order for a customer who completed the Mail-in Audit during the period January 1, 2003 through March 31, 2003 to be counted as a participant in SCE's PY 2002 Mail-in Audit, they had to have been sent the Mail-in survey during the period April 1, 2002 through December 31, 2002. The names, addresses, and account numbers of those customers who were sent the Mail-in survey during the period April 1, 2002 through December 31, 2002 were merged with those who completed their Mail-in Audit during the period January 1, 2003 through March 31, 2003. Matches resulting from this merge

were counted as participants in the PY 2002 Mail-in Audit. PG&E counted as PY 2002 participants *all* those who completed the Mail-in Audit during the period January 1, 2003 through February 28, 2003. PG&E argues that since they did not mail out any surveys during the first two months of 2003, customers who completed their Mail-in Audits during the first two months of 2003 must have responded to mailings conducted in 2002 and therefore should be counted as participants in the PY 2002 Mail-in Audit.

All four utilities defined their program period for Online Audits as April 1, 2002 through December 31, 2002. Table 2-7 presents these program period definitions.

Table 2-7
Program Period Definitions,
by Utility, by Audit Type

Utility	Mail-in Audit	Online Audit
PG&E	4/1/02 - 2/28/03	4/1/02 - 12/31/02
SCE	4/1/02 - 3/31/03	4/1/02 - 12/31/02
SDG&E	4/1/02 - 12/31/02	4/1/02 - 12/31/02
SoCalGas	4/1/02 - 12/31/02	4/1/02 - 12/31/02

2.4 Program Outreach

The utilities used a variety of strategies to inform customers of the Mail-In and Online audits. In Table 2-4 above, we presented the number of surveys mailed directly to customers for each utility. For part of 2002, to increase participation, SCE included a promotion in conjunction with Blockbuster Video stores. Customers who returned a completed survey received a coupon for a free movie rental at Blockbuster. In addition, several utilities worked with community-based organizations to inform customers about the Mail-In Audit.

Reaching the HTR population is challenging. That the CPUC has established five criteria for defining the HTR customer population is a start. However, identifying where these customers actually live is challenging. All four IOUs operationally defined hard-to-reach customers by the ZIP code in which they lived. While rural areas are relatively easy to identify, there is a great deal of variation within these ZIP codes with respect to the other four criteria. To increase the probability of reaching the HTR customers, utilities targeted ZIP codes with high proportions of customers who met one or more of the other four HTR criteria. Some utilities relied on the Statewide Residential Customer Needs Assessment Study (Reed et al., 2001) to identify those California ZIP codes with high proportions of HTR customers. In this study, because 1990 decennial Census data were considered out of date, other sources, such as a dataset produced by Claritas called PRIZM, were used to locate and analyze the populations of interest. PRIZM defines the American population in terms of 62 segments. Other utilities attempted to rely on the now available 2000 decennial Census data. After identifying these HTR ZIP codes, some utilities went further and examined the kWh use patterns within these ZIP codes and targeted those customers with high use. For example, they identified those ZIP codes with a high proportion of moderate-to-low income customers who had high levels of energy consumption. The belief was that if you were

moderate income and had high-energy use, you would benefit more by participating, and, as a result, be more likely to participate.

Outreach for the Online Audit involved a variety of strategies. Table 2-8 presents these strategies, by utility.

Table 2-8
Online Audit Outreach Strategies, by Utility

Utility	Website	Utility Newsletter	Bill Inserts	E-Mail Blasts	On-Line Ads	Direct Mail
PG&E	WWW.PGE.COM	Electronic newsletter	Yes	4,910 customers	Web banner on third party Web sites	No
SCE	WWW. SCE.COM	No	Yes	1,756,000 customers	4,090,200 on-line impressions	Yes
SoCalGas	WWW.SOCCALGAS.COM	Yes	No	No	No	No
SDG&E	WWW.SDGE.COM	Yes	No	No	Pop-up ads on utility website	No

2.5 Evaluation Goals

Four evaluation goals, consistent with the requirements of the Energy Efficiency Policy Manual (CPUC, 2001) for information-only programs, were addressed as part of this evaluation.

1. Verify the number of residential energy audits completed under the PY2002 statewide program.

2. Evaluate program success by estimating the savings that can be attributed to the program based on a verification of audit-recommended measure implementation rates for both measures and practices. Two sub-objectives were pursued:

   c) Evaluate the success of the statewide Mail-in Audit by estimating the savings that can be attributed to the program based on a verification of audit-recommended measure implementation rates for both measures and practices.

   d) Evaluate the success of the SCE Online Audit by estimating the savings that can be attributed to the program based on a verification of audit-recommended measure implementation rates for both measures and practices.

3. Assess the impact of the HEES Program on customer awareness and knowledge of energy efficiency opportunities.

4. Provide ongoing feedback and corrective guidance regarding program design and implementation.

2.6 Program-Tracking Databases

As one of the first tasks in this evaluation, we requested the PY 2002 program-tracking databases for each of the five audit programs:

1. Statewide Mail-In Audit
2. PG&E Online Audit
3. SCE Online Audit
4. SoCalGas Online Audit, and
5. SDG&E Online Audit.

The audit, the organization responsible for maintaining the database, and the results of our requests are presented in Table 2-9.

Table 2-9
Results of Database Requests, by Implementer, by Audit Type

Audit	Database Maintenance	Results
Mail-in Audits for PG&E	Kema-Xenergy	Provided
Mail-in Audits for SCE	Kema-Xenergy	Provided
Mail-in Audits for SoCalGas	Kema-Xenergy	Provided
Mail-in Audits for SDG&E	Kema-Xenergy	Provided
Online Audits for SCE	Kema-Xenergy	Provided
Online Audits for PG&E	Nexus	Provided
Online Audits for SDG&E	Enercom	Provided
Online Audits for SoCalGas	SoCalGas	Not Provided

The extent to which we were able to address the four evaluation objectives was affected not only by the availability of the program-tracking databases but the information each contained. Five key pieces of information are required:

1. Contact information such as name, telephone number, mailing address, or e-mail address
2. Recommendations made as a result of the audit
3. KWh and therm savings estimates for each recommended measure and practice.
4. ZIP codes
5. Program documentation

The first is necessary in order to conduct a mail, telephone or Internet survey. The second is necessary in order to ask which specific, audit-recommended measures and practices they adopted. The answers to these questions would allow us to calculate an adoption rate for each respondent. The third is necessary so that the kWh and/or therm savings could be estimated based on self-reported adoptions. The fourth is necessary so that we can determine the geographical distribution of participants, and, more specifically, how these participants were distributed across HTR ZIP codes. The fifth is necessary in order to provide basic descriptions of the various audit types. Table 2-10 presents the availability of these data for the Mail-In Audit and the four Online Audits.

Table 2-10
Available Evaluation Data, by Utility

Utility	Account Number	Mail Address	E-Mail Address	Recommendations Retained in Database	Estimates of kWh and/or Therm Savings	ZIP Codes	Program Documentation
Mail-In Audit for All Four IOUs	Yes	Yes	N/A	Yes	Yes	Yes	Yes
PG&E Online	No	No	Voluntary	Yes	Yes	Yes	Yes
SCE Online	Yes	Yes	Voluntary	Yes	Yes	Yes	Yes
SoCalGas Online	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Yes
SDG&E Online	Voluntary	Yes	Voluntary	No	No	Yes	Yes

All necessary information was available for the Mail-In Audit for all four IOUs. This was also the case for the SCE Online Audit, which required participants to provide their SCE account number, which was used to retrieve all the essential information.

The PG&E Online Audit did not collect the customer's name, address, or telephone number and asked the participant to voluntarily submit their e-mail address. A database containing the recommendations for each customer and the associated savings was provided, but there was no way to link these data to the 4,003 customers willing to provide their e-mail address. This made it impossible to address the second objective. Having only 4,003 e-mail addresses created a number of additional problems. First, there was the concern that those who provided an e-mail address might be systematically different from those who were unwilling to provide their e-mail address. Second, an Internet version of the survey would have to be created in order to contact these customers, and such surveys have had low response rates in the past. All of these issues were ultimately rendered moot when PG&E chose not to evaluate its Online Audit. There were two reasons for this decision. First, there were concerns about negative customer reactions to unsolicited e-mails. Second, it made little sense to expend measurement and evaluation resources on the Online Audit since it receives only a very small portion of the HEES annual budget. Not being able to survey the 4,003 participants meant we could not meet the third evaluation objective for PG&E. However, with the database provided combined with other information such as an in-depth interview with the Program Manager and other documentation, we were able to meet the first and fourth evaluation objectives for this utility.

For SDG&E, while all necessary customer contact information was provided, no information about the recommended measures and practices and associated savings were provided. This made it impossible to meet the second evaluation objective.

Finally, for SoCalGas, failure to provide a program-tracking database meant that only the fourth evaluation objective could be met. We provide only basic information about the program based on an in-depth interview with the Program Manager, information from the quarterly reports submitted to the CPUC, and some minimal documentation provided by SoCalGas.

Table 2-11 summarizes the evaluation goals that could be addressed, given the available data.

Table 2-11
Evaluation Objective, by Audit Type, by Utility

Audit Type	Utility	Verification of Completed Audits	Estimation of Savings	Assessment of Awareness & Knowledge	Provision of Construction Feedback & Guidance
Mail-In	PG&E	X	X	X	X
	SCE	X	X	X	X
	SoCal Gas	X	X	X	X
	SDG&E	X	X	X	X
Online	PG&E	X			X
	SCE	X	X	X	X
	SoCal Gas				X
	SDG&E	X		X	X

3 Methods

This study covers both the Mail-in and Online Audits and will include process evaluation, impact evaluation, and market assessment components. Our approach to meeting each of the four evaluation objectives is provided in this section.

3.1 Data Collection

In addition to the data contained in the program-tracking databases, discussed earlier in Section 1.6, we also collected information from a sample of program participants. In this section, we describe the sample design, the data collected, the telephone interviewing process, and the achieved sample.

3.1.1 Sample Design

The design of the various samples was driven by the available data contained in the various audit program databases. We initially identified three key variables by which the sample could be stratified.[2] First, we decided that we would attempt to interview participants approximately 12 months after their audit. To be certain that all participants we interviewed had approximately the same amount of time to adopt recommended measures, we decided to conduct interviews in three waves, covering participants in three periods:

- April 1, 2002 through June 30, 2002,
- July 1, 2002 through September 30, 2002, and
- October 1, 2002 through program end.

Since we expected that adoption/implementation rates would likely vary by weather zone, we explored the possibility of stratifying by California Energy Commission (CEC) Title-24 weather zones. Because we also expected that adoption/implementation rates would likely vary by kWh usage, we considered stratifying the samples by annual kWh use, using the Dalenius-Hodges technique (Cochran, 1977) to identify three annual kWh use categories (large, medium, and small). Table 3-1 presents the data available for *stratifying* the sample, by audit program, by utility, by kWh usage, and by climate zone.

[2] Stratification has the effect of increasing the precision of the estimates over that produced by a simple random sample of the same size.

Table 3-1
Data Available for Stratification,
by Utility, by Audit Type

Audit Type	Utility	Annual Energy Use (kWh and/or Therms)	ZIP Code (Link to CEC Climate Zones)	Audit Date
Mail-In	PG&E	X	X	X
	SCE	X	X	X
	SoCalGas	X	X	X
	SDG&E	X	X	X
On-Line	PG&E	No Data	No Data	X
	SCE	X	X	X
	SoCalGas	No Data	No Data	No Data
	SDG&E	No Data	X	X

3.1.2 Statewide Mail-in Audit and SCE's Online Audit

For the Mail-in audit, a proportional, random sample, stratified by three time periods, up to five climate zones and three levels of kWh usage, was explored for each utility. However, our analysis of the data from the Kema-Xenergy-maintained database revealed that, with a sample design involving a maximum of 45 cells (3 time periods X 3 usage strata X 5 climate zone strata), the number of participants was far too sparse within too many cells. Even after eliminating the usage strata, resulting in 15 cells (3 time periods x 5 climate zones), the number of participants was still too sparse within too many cells. As a result, for each utility, we decided to proportionally stratify the sample by time period only. The sample design for the Mail-in Audit is presented in Table 3-2.

Table 3-2
Sample Design for Mail-in Audit

	PG&E Mail-In			SCE Mail-In			SoCalGas Mail-In			SDG&E Mail-In		
	Wave			Wave			Wave			Wave		
	1	2	3	1	2	3	1	2	3	1	2	3
Population	3,851	13,051	3,946	86	1,253	15,177	3,316	97	2,281	352	24	1,752
Interview Pool	693	2,348	710	86	284	3,446	2,184	64	1,502	352	24	1,752
Quota	14	47	14	0	6	69	44	1	30	12	1	62

Table 3-2 shows, for each utility and time period, the total population of participants for the period April 1, 2002 though December 31, 2002, the size of the interview pool provided to Quantum Consulting, and the quota. The quotas for each utility and time period vary depending on the number of participants. A total of 75 interviews were to be completed for each utility. At

the utility level, 75 completes would provide estimates of savings slightly beyond the 90 percent level of confidence, plus or minus 10 percent. Across all four utilities, this results in 300 completed interviews, which would provide estimates of savings beyond the 95 percent level of confidence, plus or minus 5 percent.

3.1.3 SCE and SDG&E Online Audits

The same stratification scheme used for the Mail-in Audit was used with the goal of completing 75 interviews yielding estimates of savings at the 90 percent level of confidence, plus or minus 7 percent. The sample design for SCE's Online Audit is presented in Table 3-3. Note that for SCE Online Audit participants, telephone numbers were available for the vast majority of participants.

For the SDG&E Online Audit, although it was possible to stratify by CEC climate zone, we decided to draw a simple random sample from the program-tracking database since 99 percent of the participants reside within two of the four climate zones and, within these two climate zones, they are fairly evenly distributed. Since we did not ask participants about any installations of specific audit-recommended measures and practices (and therefore did not stratify by time-period), the interviews were completed in one wave. The sample design for the SDG&E Online Audit is also presented in Table 3-3.

Table 3-3
Preliminary Sample Design for SCE and SDG&E Online Audit

	SCE On-Line			SDG&E On-Line
Frequencies	Period 1	Period 2	Period 3	N/A
Population	1,007	1,207	5,566	3,058
Interview Pool	485	582	2,683	3,058
Quota	10	12	54	75

The preparation of the samples for each audit type involved several steps.

Statewide and SCE Online Audits. First, for the statewide Mail-in and SCE Online Audits, the recommendations made to each participating customer were obtained from the Mail-in and Online Audit databases. Next, the relatively few customers without telephone numbers were eliminated. Finally, we screened out customers who have implausibly small or large monthly kWh consumption. In summary, before the sample was drawn, customers with certain characteristics were eliminated:

- customers with less than 600 kWh/year
- customers with greater than 70,000 kWh/year
- customers with no record of consumption

SDG&E Online Audits. First, the duplicates in the file provided by SDG&E were eliminated. Then, those relatively few customers with missing telephone numbers were eliminated.

3.2 Data Collected

The data collected for the Mail-in and SCE Online Audits included the following topics:

- self-reported recall, awareness, and adoption of *specific* measures and practices recommended as a result of the audits
- attitudes toward energy efficiency and energy conservation
- awareness of ENERGY STAR®and utility- and state-sponsored DSM programs
- knowledge of energy conservation and energy efficiency
- past participation in the DSM programs
- satisfaction with the audit program
- demographic characteristics
- how participants were informed about the audit.

The final version of the Mail-in and SCE Online questionnaire that was coded for the CATI system can be found in Appendix F.

The data collected for the SDG&E Online Audits included:

- self-reported recall as to whether and how many measures and practices recommended as a result of the audits participants adopted
- attitudes toward energy efficiency and energy conservation
- awareness of ENERGY STAR®and utility- and state-sponsored DSM programs
- knowledge of energy conservation and energy efficiency
- past participation in the DSM programs
- satisfaction with the audit program
- demographic characteristics
- how participants were informed about the audit

The final version of the SDG&E Online questionnaire that was coded for the CATI system can be found in Appendix G.

3.3 Telephone Interviews

The interviewing process began with a pre-test of 26 interviews after the interview was coded into the CATI system. During those interviews a coding error was discovered. The error was corrected and the interviews were discarded. Another 12 interviews were conducted, followed by an assessment of accuracy and feasibility. The interview and process were working well and interviewing was resumed, using those 12 interviews as completes. While the interviews were translated into Spanish and the interviewers were prepared to conduct interviews in Spanish, none of the completed interviews were ultimately conducted in Spanish.

The data collected for each of the participants in the audits evaluated are presented in the following sections.

3.3.1 Timing of the Interviews

The interviews were conducted in three waves. Those participating in the statewide Mail-in Audits and the SCE Online Audit in the period April 1, 2002 through June 30, 2002 were interviewed in August 2003 so that they would have had at least a full year to adopt any of the recommended measures and practices.[3] Those who participated in the period July 1, 2002 through September 30, 2002 were interviewed in October 2003. Finally, those who participated in the period October 1, 2002 through December 31, 2002 were interviewed in January 2004.

Note that PG&E and SCE defined their program year for the Mail-in Audit as April 1, 2002 through February 28, 2003 and April 1, 2002 through March 31, 2003[4], respectively. To wait a full 12 months to interview those who participated in the first quarter of 2003 would have required that data collection begin in March or April of 2004, delaying the final report until late May or early June 2004. This was considered unacceptable. Thus, PG&E and SCE customers who participated in the first quarter of 2003 *were not* interviewed. The assumption is that those participating in the first quarter of 2003 are not different in any important respects from those who participated from April 1, 2002 through December 31, 2002.

3.4 Achieved Sample

The research plan provided a sampling plan that included quotas for completed interviews for each program/utility in each of three periods. Table 3-4 shows the quotas and the final achieved sample for each utility.

[3] Delays in obtaining the data from the various program-tracking databases, described in Section 1.1, have delayed the first round of data collection, originally scheduled for July until August. This means that those participating in the period April 1, 2002 through June 30, 2002 will actually have 13 months to adopt any of the recommended measures and practices, one month longer than those interviewed in October 2003 and January 2004.

[4] In order for a customer who completed the Mail-in audit during the period January 1, 2002 through March 31, 2003 to be counted as a participant in SCE's PY 2002 Mail-in audit, they have to have been sent the Mail-in survey during the period April 1, 2002 through December 31, 2002. The names, addresses, and account numbers of those customers who were sent the Mail-in survey during the period April 1, 2002 through December 31, 2002 were merged with those who completed their Mail-in audit during the period January 1, 2003 through March 31, 2003. Matches resulting from this merge were counted as participants in the PY 2002 Mail-in audit. PG&E counted as PY 2002 participants all those who completed the Mail-in audit during the period April 1, 2002 through March 28, 2003. PG&E argues that, since they did not mail out any surveys during the first two months of 2003, customers who completed their Mail-in audits during the first two months of 2003 must have responded to mailings conducted in 2002 and therefore should be counted as participants in the PY 2002 Mail-in audit.

Table 3-4
Quotas and Achieved Interviews
by Utility/Program Combination

Utility/Program	Quota	Achieved Sample
PG&E Mail-in	75	76
SCE Mail-in	75	75
SCG Mail-in	75	76
SDG&E Mail-in	75	76
SCE On-line	75	76
SDG&E On-line	75	121*

* Quota of 75 was exceeded

An analysis of the interviewing process is presented below. Table 3-5 shows the disposition of the total sample provided to Quantum Consulting for those interviews, broken down by utility and program. Table 3-6 shows the efficiency and completion rates for the sample.

Table 3-5
Achieved Sample

Disposition	PG&E Mail	SCE Mail	SDG&E Mail	SCG Mail	SCE Online	Total	Percent
Completed	76	75	76	76	76	379	25.3%
Terminated	2	2	3	8	3	18	1.2%
Did not pass screening questions	5	10	22	35	21	93	6.2%
No answer	15	32	18	37	22	124	8.3%
Line busy	5	8	5	28	18	64	4.3%
Wrong number/disconnected	24	25	26	40	20	135	9.0%
Refused	14	14	15	46	15	104	6.9%
Answering machine	82	58	67	135	103	445	29.7%
Appropriate person not available	13	13	9	23	8	66	4.4%
Unable to answer questions	1	0	1	0	1	3	0.2%
Language barrier	2	13	1	10	2	28	1.9%
Business or fax machine	5	8	7	9	11	40	2.7%
Total Calls	244	258	250	447	300	1,499	100.0%

The completion rates for these programs vary from 23.5 percent to 43.6 percent. These are fairly low completion rates.

Table 3-6
Cumulative Efficiency and Completion Rates
For RECAP Participants

Completion Rates	PG&E Mail	SCE Mail	SDG&E Mail	SCG Mail	SCE Online	Total
Pool Efficiency Rate	88.1%	87.2%	86.8%	89.0%	89.7%	88.3%
Gross Completion Rate	31.1%	29.1%	30.4%	17.0%	25.3%	25.3%
Eligible Completion Rate	39.6%	43.6%	39.6%	23.5%	33.6%	34.3%

3.5 Analysis

In this section, we present the analytical methods used in achieving the four goals of this evaluation.

3.5.1 Verification of Completed Energy Audits

We conducted a review of the Kema-Xenergy-maintained database in order to determine the number of Mail-in Audits *completed* by the four utilities. For SCE, we reviewed the entire Kema-Xenergy-maintained database in order to determine the number of Online Audits completed. We also reviewed the Online Audit databases maintained by Nexus and Enercom to verify the number of Online Audits completed by PG&E and SDG&E customers, respectively. Recall that for both SoCalGas and SDG&E the participation objectives were based on the number of surveys mailed out rather than the number of surveys completed. To verify the number of surveys mailed by SoCalGas and SDG&E, we reviewed data provided by Kema-Xenergy, which was responsible for implementing the mailings. However, for SoCalGas, we did not receive a program-tracking database and were therefore not able to verify the number of Online Audits *completed.* All files used in this verification task are presented in Appendix M, Data Documentation.

Verification results are reported at three levels: 1) statewide, 2) utility, and 3) HTR. We also analyzed the results of in-depth interviews with utility-specific project managers and staff. In addition, copies of all available program-related materials were acquired and examined.

3.5.2 Estimation of the Savings

In this section, we provide a description of how the savings for the statewide Mail-in Audit and SCE's Online Audit (which used the RECAP software) were estimated. Estimates based on billing analysis were ruled out early in the process due to budget constraints. Instead we collected data from a sample of participants that could be combined with data from the Kema-Xenergy database to estimate the total gross energy savings for the program.[5] This approach was

[5] We considered another approach, one that was used recently in the evaluation of SCE's PY 2000 residential audits: 1) Mail-in Audit, 2) Online Audit, 3) In-Home Audit, and 4) Telephone Audit (SCE, 2002). The approach also involves a ratio approach, but one that requires an earlier estimate of kWh, kW, and therm impacts from a prior evaluation of the Mail-in and Online Audits. This approach would work reasonably well if there are prior estimates of savings for the Mail-in Audit and Online Audit for each utility. Unfortunately, there is no prior regression-based impact estimate for the Online Audit, for any of the four utilities. One would have to assume that the savings are identical to the Mail-in Audit impacts. Based on the prior SCE study (SCE, 2002), this may not be reasonable. With respect to the Mail-in Audit, only SCE has any experience implementing it.

preferred because it allowed for a uniform and reliable approach to estimating savings across all four utilities. While the method is uniform, it does take variation in weather conditions into account, since RECAP savings algorithms include weather variables.

The original estimates of kWh and therm savings were created using the RECAP software, which processed all audit information provided by participants. The adoptions reported by the sample of Mail-in and Online Audit participants who completed the telephone interview were then merged with their associated RECAP data, which contained the original estimates of kWh and therm savings for all audit-recommended measures and practices. The expected savings for each participant were calculated based on their self-reported adoptions.

Self-reported adoptions of recommended measures and practices were collected from a stratified random sample of 303 participants in the statewide Mail-in Audit, and 76 participants in SCE's Online Audit. Quantum Consulting interviewers were given the specific recommendations made to each participant in the interview sample. In addition to a variety of other questions asked during the interview, participants were asked whether they had adopted each recommended measure and practice following their audit. Using this information, adoption ratios were calculated.

While an additional 121 interviews were completed with participants in the SDG&E Online Audit Program, reliable adoption ratios could not be calculated since audit recommendations were not retained in the program-tracking database. These participants were simply asked to estimate the number of audit recommendations made.

The accounts for those participants in the Mail-In and SCE Online Audits who completed the telephone interview were merged with the RECAP file in order to obtain the estimated savings associated with each recommendation. The savings associated with each adopted recommendation were then summed for each respondent.

Both the total savings and the mean savings for the population of participants were estimated. For the statewide Mail-in Audit, these savings were estimated statewide and for each utility. Savings were also estimated for the SCE Online Audit. We first discuss how the means were estimated, followed by a discussion of how the totals were estimated.

Calculation of Mean

Based on the achieved sample, the mean is then calculated as:

$$\bar{y}_{st} = \sum_{h=1}^{L} W_h \bar{y}_h \qquad (1)$$

where $W_h = \frac{N_h}{N}$ which is the stratum weight

Therefore, only SCE has a prior estimate of the savings for the Mail-in Audit (Study 528-B). For these reasons, we rejected this approach.

$\bar{y}_h$ = the mean of y for stratum h, where a stratum is one of the four utilities

$\bar{y}_{st}$ = the mean resulting from a stratified random sample (*st* for *stratified*).

Calculation of Variance of the Mean

With stratified random sampling, an unbiased estimate of the variance of $\bar{y}_{st}$ is:

$$s_2(\bar{y}_{st}) = \sum_{h=1}^{L} \frac{W_h^2 \, s_h^2}{n_h} - \sum_{h=1}^{L} \frac{W_h s_h^2}{N} \qquad (2)$$

Note that the second term in equation 5 represents the finite population correction.

Calculation of Confidence Intervals for the Mean

The formula for the confidence intervals is:

$$\bar{y}_{st} \pm ts(\bar{y}_{st}) \qquad (3)$$

where t = the critical value from the t distribution
$s(\bar{y}_{st})$ = the standard error of $\bar{y}_{st}$.

The critical values for the 90 percent and 95 percent levels of confidence are 1.64 and 1.96, respectively.

Calculation of the Population Total

$$\text{PopulationTotal} = N\bar{y}_{st} \qquad (4)$$

Calculation of Confidence Intervals for the Total

$$\text{PopulationTotal} = N\bar{y}_{st} \pm tNs(y_{st}) \qquad (5)$$

3.5.3 Assessment of the Awareness and Knowledge Impacts

The survey of 303 Mail-in participants for all four utilities, 121 Online participants for SDG&E, and 76 SCE online participants was also used to assess customer awareness, behaviors, and knowledge with respect to energy efficiency opportunities. These survey results were compared to a baseline survey, "CBEE Baseline Study on Public Awareness and Attitudes Toward Energy Efficiency" conducted by Hagler-Bailly Consulting in 1999. The wording of these questions is exactly the same as those used in this baseline study so that legitimate comparisons can be made over time.

3.5.4 Process Evaluation

The process evaluation was designed to address a number of research questions regarding the design and implementation of the HEES Program. The primary purpose of the process evaluation was to meet the fourth evaluation goal, to provide ongoing feedback to all relevant stakeholders so that mid-course corrections could be made in the design and implementation of the HEES Program. This process evaluation addressed research questions in four general categories.

With respect to program outreach, we addressed the following research questions:

- To what extent did the design of the IOU Mail-in and Online Audits vary by service territory?[6]
- Who were the target audiences for each audit type and how do they differ from the general customer population?
- What is the geographic distribution of the participating households?
- What are the acceptance or penetration rates for each type of audit, both statewide and by utility?

Regarding the hard-to-reach population, we addressed the following questions:

- How were hard-to-reach customers (HTR) defined by the utilities and the CPUC?
- What strategies were used to contact the hard-to-reach customers?
- Were all types of HTR customers targeted by the four IOUs?
- How effective were the strategies used to contact the hard-to-reach customers?

Finally, we examined a variety of questions regarding the characteristics of the participants:

- What are the characteristics of the participating households?
- How were they informed about the opportunities for the Mail-in or Online Audits?
- To what extent are participants satisfied with their audits?
- What are participants' attitudes toward energy conservation and efficiency?

As data were collected, they were analyzed and results reported in a series of progress memos to Program Managers at the four utilities and their Evaluation, Measurement, and Verification (EM&V) counterparts.

3.5.5 Weights

When estimating parameters, such as the proportion of renters versus owners, among the participants within a given utility, no weights were necessary since the sample was a proportional, stratified random sample. That is, the sample for each utility is self-weighting. However, when estimating certain parameters, such as the adoption rate for all participants, across all four utilities, the situation is no longer self-weighting, because each utility is now

[6] This is critical since in D. 01-11-066, the Commission concluded that statewide programs will continue to be the backbone of EE policy for 2002, and that they must be uniform, with consistent terms and requirements in all utility service areas.

considered a stratum and the sampling is disproportionate within each stratum. Some weighting is required.

One could use the expansion weight (Lee, Forthofer, and Lorimor, 1993), which is simply the reciprocal of the selection probability and is calculated as follows:

$$\text{Expansion Weight} = \frac{N_h}{n_h} \qquad (6)$$

where
N_h = Population in stratum h
n_h = Sample in stratum h

These expansion weights return the number of participants in each stratum.

However, while the expansion weights are reasonable for estimating population totals and means, they may play havoc with the standard error and significance tests, such as that for the Chi-square and analysis of variance. To deal with this problem, the expansion weight was adjusted to produce the relative weight, rw_i, which is defined as the expansion weight divided by the mean of the expansion weights (Lee, Forthofer, and Lorimor, 1993):

$$\text{Relative Weight} = \frac{w_i}{\overline{w}} \qquad (7)$$

where

$$\overline{w} = \frac{\sum w_i}{n}$$

The relative weights, applied to respondents in each audit type, return the number of completed questionnaires.

4 Results

4.1 Verification of Completed Audits

We reviewed the available program-tracking databases to determine the extent to which utilities met their respective targets for both Mail-In and Online Audits. Table 4-1 and Table 4-3 present the targets, the numbers reported in utilities' fourth-quarterly reports, and the number of audits that we were able to verify through our review of the program-tracking databases.

Table 4-1
Verified Completed Mail-in Audits
by Utility Fourth Quarter Report, by Target

Utility	Target	4th Quarter Report	Verified
PG&E	18,000	20,872	22,371
SCE	18,000	20,100	22,612
SoCal Gas	3,000	3,590	5,704
SDG&E	4,000	4,028	2,128
Total	43,000	48,590	52,815

Mail-In Audit acceptance or "take" rates, defined as the number of verified Mail-In Audits divided by the number of audits mailed directly to customers, are presented in Table 4-2.

Table 4-2
Acceptance Rates, by Utility

Utility	Direct Mail Pieces	Verified Audits	Acceptance Rate
PG&E	219,880	22,371	10.2%
SCE	264,853	22,612	8.5%
SoCalGas	56,576	5,704	10.1%
SDG&E	18,453	2,128	11.5%
Overall	559,762	52,815	9.4%

Table 4-3
Verified Completed Online Audits,
by Utility Fourth Quarter Report, by Target

Utility	Target	4th Quarter Report	Verified
PG&E	12,000	9,146	8,936
SCE	12,000	10,057	9,061
SoCal Gas	2,000	1,507	No Data Provided
SDG&E	2,667	1,721	3,058
Total	28,667	22,431	21,008

With respect to completed Mail-In Audits, PG&E and SCE exceeded both their targets and the numbers reported in their fourth quarter reports. To interpret the results for SoCalGas and SDG&E, recall that both utilities defined their targets in terms of audit surveys mailed out rather than audit surveys completed. According to this definition, both SoCalGas and SDG&E exceeded their targets, with 56,576 and 18,453 direct mail solicitations, respectively.

Regarding the Online Audit, only SDG&E exceeded its target. Both PG&E and SCE failed to meet their respective targets. Finally, while SoCalGas claimed in its 4th Quarter Report to have completed 1,507 Online Audits (946 short of its target), we could not verify this number since the utility did not provide its program-tracking database.

4.2 Population Characteristics

By reviewing the available program-tracking databases, we were able to determine a number of important population parameters, including the total number of recommendations, the specific measures and practices recommended, and the average number (and proportion) of measures and practices recommended:

- Mail-Audit
- SCE-Online Audit
- PG&E Online Audit

In Table 4-4, we first present the number of unique measures and practices recommended by the four utilities in PY 2002. When reviewing these numbers, it is important to recognize that, while HEES is a statewide program, each utility must tailor, to some extent, the kinds of recommendations that are possible and the customer and household characteristics that trigger certain recommendations. This seems quite reasonable given the utilities' long history of serving diverse customer groups. This history provides each utility with a deep understanding of the needs and wants of each customer base, which is characterized by its own set of unique demographic and household characteristics.

Table 4-4
Number of Unique Measure and Practices
Recommended in PY 2002, by Utility and Audit Type

Utility	Audit Type	Unique Measures & Practices
PG&E	Mail-In	39
SCE	Mail-In	32
SoCal Gas	Mail-In	17
SDG&E	Mail-In	23
SCE	Online	32
PG&E	Online	65

The number of unique measures for the Mail-In Audit is highest for PG&E, which is partly due to the fact that it is the largest dual fuel utility in California. PG&E's Online Audit has the highest number of recommendations partly for the same reason. It might also be due to the fact that the software created and maintained by Enercom is different than that used to generate recommendations for the Mail-In Audit, which was created and maintained by Kema-Xenergy. Different algorithms will generate a different set of recommendations as well as a different number of recommendations.

SoCalGas has the fewest number of unique recommendations because it is a single fuel utility. However, SCE is a single fuel utility and it has 32 unique recommendations, probably reflecting that there are simply more electricity savings opportunities than there are gas savings opportunities. It might also reflect each utility's need to tailor the audit to the needs of each own unique customer base.

Moreover, the number of weather zones that characterizes each utility will by itself produce differences in the number of unique measures and practices recommended. Figure 4-1 presents the Title-24 weather zones established by the California Energy Commission (CEC).

Figure 4-1
CEC Title-24 Weather Zones

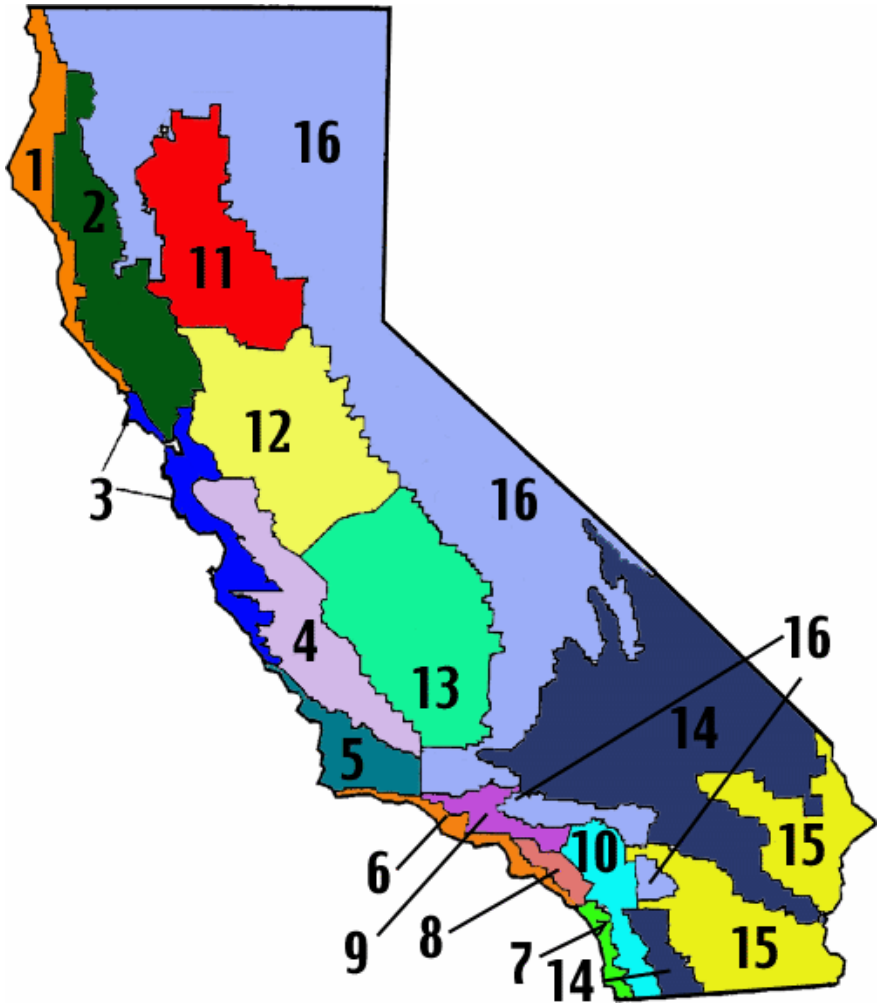


Table 4-5 presents the frequency with which utility ZIP codes fall within these 16 CEC Title-24 weather zones.

Table 4-5
Frequency of Utility ZIP Codes, by Title-24 Weather Zones

Title-24 Weather Zones	PG&E	SCE	SoCalGas	SDG&E	Total
1	48	0	0	0	48
2	115	1	0	0	116
3	268	0	0	0	268
4	145	1	6	0	152
5	38	2	23	0	63
6	0	67	77	8	152
7	0	0	1	64	65
8	0	73	83	7	163
9	0	39	169	0	208
10	0	92	72	29	193
11	109	0	0	0	109
12	359	0	0	0	359
13	152	46	63	0	261
14	7	54	22	16	99
15	0	22	32	1	55
16	82	64	24	0	170
Total	1,323	461	572	125	2,481

Next, we present information on the mean number of recommendations made in the Mail-In and the SCE and SDG&E Online Audits. Table 4-6 presents the mean number of recommendations overall and by measures versus practices. The average number of recommendations was 5.3 with more measures recommended than practices. Appendix H presents the frequencies for the measures recommended in the Mail-In Audit, while Appendix I present the frequencies for the measures recommended for the SCE and PG&E Online Audits.

Table 4-6
Overall Average Number of Recommendations

Recommendations	Average Per Audit
All Recommendations	5.3
Measures Recommended	3.9
Practices Recommended	1.4

How can we put these means in context? Are they high or low? Prior evaluations of residential audits rarely report this number. The only report that could be identified was Ridge (2002) in which the number of measure and practice recommendations for SCE PY 2000 Mail-In Audit and Online Audits were 7.1 and 5.9 respectively. We suspect that the mean number of recommendations for PY 2002 is somewhat low. This might, in large part, be due to the California energy crisis of 2001, which triggered a massive statewide effort to reduce kWh consumption and kW demand. Lutsenhiser (2003) surveyed 696 SCE customers and conducted a billing analysis to determine the effect of the crisis on conservation

behavior. Eighty-two percent of the households reported an average of four changes in energy use practices per household. In November of 2002, the *Sacramento Bee* reported that "…utilities saw their per customer sales slump 6 percent to 9 percent in 2001." This is very close to the number estimated by Randazzo (2002), who found reductions in the range of 5 to 10 percent.

Lutsenhiser also found that more than 79 percent of the conserving households reported that they are likely to continue these behaviors in the future. In the same article, the *Sacramento Bee* reported that, "…nearly two years later, a partial relapse has occurred, but it's likely the state's consumers will use less electricity for years to come, according to utilities, academics and energy experts studying the legacy of California's power crisis." These findings are underscored by the results of the California Residential Market Share Tracking Reports for HVAC, appliances, and lighting (Regional Economic Research, 2001, 2002a, 2002b). All three reports show increases, in some cases rather sharp increases, in the share of equipment purchased that is energy efficient during the energy crisis of 2001.

Thus, the PY 2002 HEES was marketed to a group of customers who, on average, might have already made many of the hardware and behavioral changes promoted by the HEES Audits. Respondents manifested very positive attitudes toward energy efficiency and conservation and 86 percent reported that they were already aware of the benefits of the measures and practices recommended. Table 4-7 presents the overall mean as well as the mean number of recommended measures and practices, by utility.

Table 4-7
Overall Mean Number of Recommendations, Mean Number of Measures, Mean Number of Practices, by Utility

Utility	Mean Number of Measures	Mean Number of Practices	Overall Mean Number of Recommendations
PG&E Mail	6.4	1.1	7.5
SCE Mail-In	3.0	1.3	4.3
SoCal Gas Mail-In	2.3	3.0	5.3
SDG&E Mail-In	3.2	1.4	4.7
SCE Online	4.5	1.3	5.8
PG&E Online	0.9	0.7	1.7
Overall	3.9	1.3	5.3
Overall Excluding PG&E Online*	4.2	1.3	5.5

* Because the PG&E Online results were considered outliers, we exclude them from the calculation of means.

When reviewing these numbers, it is important to understand that the number of recommendations is a function of the number of audits completed, whether a utility is a dual or single fuel utility, whether the single fuel utilities are electric or gas, the mix of customers who participated, and the number and characteristics of the climate zones covered by each utility. With this in mind, one should avoid making invidious comparisons across utilities.

With respect to annual kWh and therm consumption, there is also a fair amount of variation. Figure 4-2 and Figure 4-3 present these results.

Figure 4-2
Mean Annual kWh Consumption, by Utility

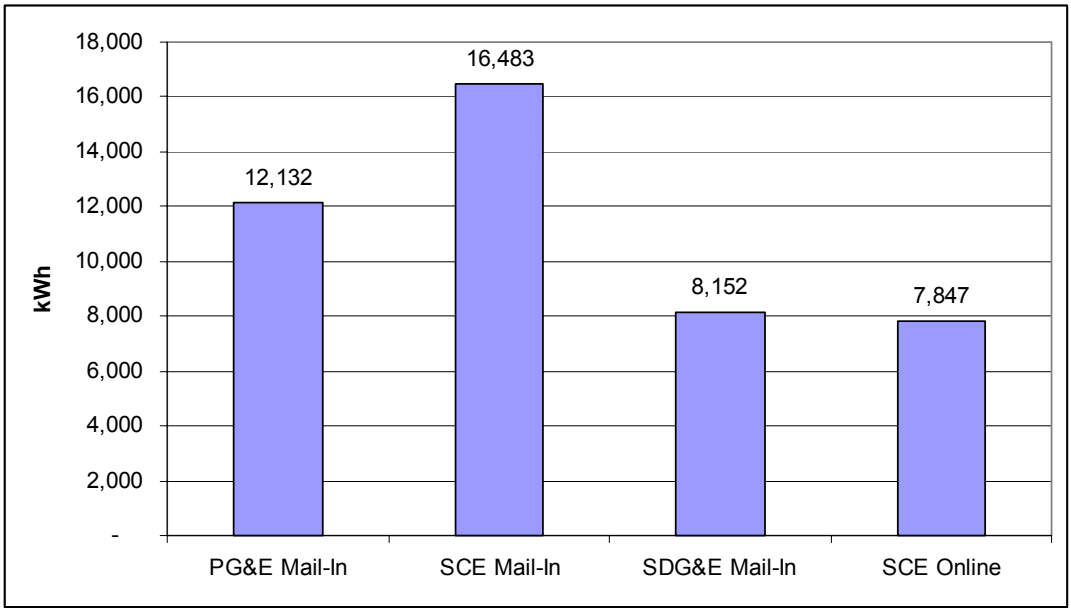
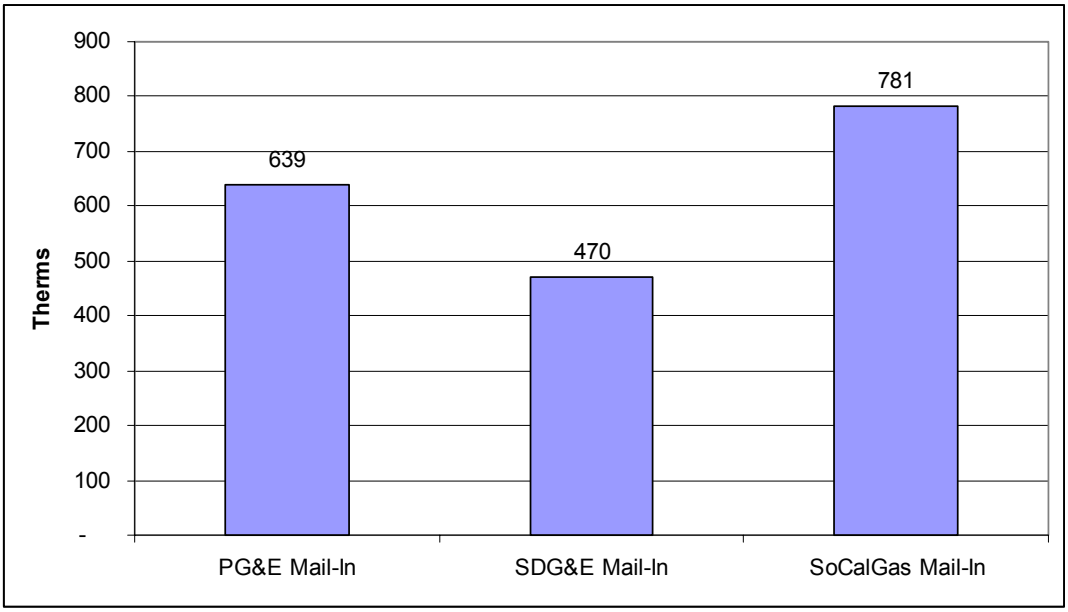


Figure 4-3
Mean Annual Therm Consumption, by Utility



For the Mail-In Audit, SCE is clearly attracting large residential customers with a mean of nearly 16,500 kWh[7]. In the evaluation of SCE's PY 2000 Mail-In Audit Program Ridge (2002) also observed a rather high mean of slightly more than 14,000. We suspect that there might have been a number of master-metered apartment buildings that participated in the program. The mean consumption of SCE's Mail-In participants is nearly 36 percent larger than that of PG&E customers and more than twice that of SDG&E Mail-In customers and SCE's Online customers. This likely reflects the fact that they market to larger customers, both the HTR and the non-HTR. SDG&E and SoCalGas also attempted to market to HTR customers (moderate income) who are also high-energy users. Using Table 4-8, these means can be compared to the mean annual kWh consumption for residential customers in 2001 for each of the three electric utilities.

Table 4-8
Residential Mean Annual kWh Consumption in 2001, by Utility

Utility	Mean Annual kWh Consumption
PG&E	6,463
SCE	6,312
SDG&E	5,506

To place PG&E's therm consumption into context, the 2003 mean annual residential therm consumption was 541 compared to 639 for participants. This suggests that customers with larger therm consumption (approximately 18 percent larger) tend to participate. Annual residential therm consumption data for SoCalGas and SDG&E were not available.

4.3 Sample Characteristics

The characteristics of program participants can be important in interpreting program impacts. These characteristics are shown in the next series of tables. The tables show the distribution of the program participants on several variables by utility program. The presentation of the results by utility program is not done to make comparisons across programs, since this is a statewide program, where all of the utilities use essentially the same program mechanisms. There are differences among utilities on a number of dimensions, but this is not likely due to any differences in the services experienced by the customer since these programs involve almost no direct contact between customer and utility. The tables are presented separately for each utility because each, for future marketing purposes, may wish to see their own customer characteristics and behavior.

The specific percentages of each sample in each table would have little meaning, even if the results for the utility programs were compared, since the make-up of the territories is different. To facilitate interpretation, comparable data from the Statewide Residential Lighting and Appliance Saturation Study (SDG&E, 2000) are presented in the tables as a point of comparison. For the variables of education and ethnicity, no saturation survey data were available. In its place, census data for the relevant areas are presented.

[7] Without first eliminating outliers, the mean would have been slightly more than 18,000 kWh per year.

4.3.1 Type of Residence

Table 4-9 reflects the historical focus of the residential audit programs on homeowners rather than renters. The interviewed sample includes proportionately fewer renters than homeowners as compared to their proportions in the customer population. Utility-specific frequencies can be found in Appendix J.

Table 4-9
Percent of Participant Homes of Each Type of Residence:
All IOUs (Weighted)

Type of Residence	Saturation Survey*	Mail	Online
Single Family Attached	2.7%	7.5%	9.1%
Single Family Detached	65.7%	90.1%	81.8%
Apartment < 5 Units	5.6%	0.6%	1.8%
Apartment 5+ Units	23.3%	0.0%	5.5%
Mobile Home	2.6%	1.9%	1.8%

*Total without SMUD

4.3.2 Household Size

Table 4-10 and Table 4-11 depict the distribution of number of people, and number of adults in participant households. Utility-specific frequencies can be found in Appendix J. The only pattern easily discernable here is that one-person households are usually slightly under-represented in the participant groups.

Table 4-10
Distribution of Total Number of People in Household:
All IOUS (Weighted)

Number in HH	Saturation Survey*	Mail	Online
1	17.8%	8.4%	7.1%
2	33.1%	35.3%	26.6%
3	18.4%	20.1%	25.0%
4	17.5%	18.0%	25.0%
5	7.0%	12.7%	10.7%
6	3.8%	3.1%	1.8%
7	1.3%	1.2%	1.8%
8+	1.1%	1.2%	1.8%

*Total without SMUD

Table 4-11
Distribution of Number of Adults in Household:
All IOUs (Weighted)

Adults in HH	Saturation Survey*	Mail	Online
1	23.8%	9.2%	9.3%
2	58.7%	59.6%	63.0%
3	11.6%	21.0%	14.8%
4	3.9%	8.3%	9.3%
5+	2.0%	1.9%	1.9%

*Total without SMUD

4.3.3 Household Income

Table 4-12 shows the income distribution of the interviewed sample across all four IOUs compared to the figures from the most recent saturation survey. Utility-specific frequencies can be found in Appendix J. By and large, the participant groups are representative of their territories. It is difficult to see any systematic patterns.

Table 4-12
Distribution of Total Household Income:
All IOUs (Weighted)

Income Range	Saturation Survey**	Mail	Online
<$25,000	15.9%	7.6%	15.8%
$25,001-50,000	25.3%	23.2%	18.4%
$50,001-75,000	17.3%	25.3%	23.7%
$75,001-100,000	12.8%	19.4%	21.1%
>$100,000	10.4%	24.5%	21.1%
Refused, DK, Vacant*	18.3%	26.7%	31.6%

*Not counted in category percentages & no vacancies in this survey
**Total without SMUD

4.3.4 Age of Home

From Table 4-13, we concluded that distribution of the age of participant homes reflects those of all customers. Utility-specific comparisons can be found in Appendix J.

Table 4-13
Distribution of Age of Home:
All IOUs (Weighted)

Age of Home	Saturation Survey**	Mail	Online
Older than 1950	11.0%	9.1%	11.3%
1950-1954	6.0%	8.4%	11.3%
1955-1959	5.2%	5.6%	3.8%
1960-1964	8.2%	6.9%	7.5%
1965-1969	7.7%	4.7%	7.5%
1970-1974	9.3%	6.6%	9.4%
1975-1979	8.7%	15.6%	15.1%
1980-1984	5.5%	7.2%	9.4%
1985-1989	11.0%	9.2%	7.5%
1990-1994	7.4%	10.0%	13.2%
1995-2001*	6.1%	16.6%	3.8%
DK/ Refused	13.7%	1.0%	3.9%

*Saturation survey covered years only through 2000.
**Total without SMUD

4.3.5 Education

Table 4-14 shows that participants in this program tend to be substantially more educated than the general population in the geographical areas they represent. This pattern held true for all utilities. However, utility-specific tables can be found in Appendix J. Participants are about twice as likely to have a college degree.

Table 4-14
Distribution of Education
All IOUs (Weighted)

Level of Education	Census Data IOU Territories	Mail	Online
No High School Diploma	23.2%	3.2%	1.8%
High School Diploma	20.1%	20.8%	9.1%
Some College	30.0%	35.5%	36.7%
College Degree	17.1%	26.5%	32.8%
Graduate Degree	9.5%	14.1%	20.0%

4.3.6 Ethnicity

In spite of considerable effort to target Hispanics and Asian-Americans, these two groups are clearly under-represented in the program compared to their representation in their geographical territories (Table 4-15).

Table 4-15
Distribution of Ethnic Groups (Weighted)

Ethnicity	Census Data IOU Territories	Mail	Online
Hispanic/Latino	32.4%	9.1%	7.7%
African-American	6.3%	4.5%	7.7%
White/Caucasian	46.6%	78.6%	71.2%
Asian-American	10.8%	3.6%	5.8%
Native American	0.5%	0.0%	0.0%
Multiple Ethnicities	2.9%	2.3%	3.8%
Other	0.5%	1.9%	3.8%

African-American participation level in the audit program seems to be approximately commensurate with that group's representation in the IOU territories. Caucasians clearly are much more likely to respond to the program's opportunities. There is approximately 67 percent more participation by Caucasians than their numbers in the general population would predict. Similar patterns were seen in all IOU territories. Utility-specific distributions can be seen in Appendix J.

4.4 Conservation Attitudes

Table 4-16 reports the mean responses of participants to seven questions meant to measure conservation attitudes. The questions were taken from CBEE (1999) baseline study that establishes public attitudes nationally about conservation so that comparisons of participants to the general population can be made. Both nationwide and statewide figures are shown in the table as points of comparison. Of course, the attribution of any differences between HEES Program participants and the California and U.S. baselines to the HEES Program is difficult to determine given the California focus on market transformation programs since 1998 and, more specifically, the proliferation of energy conservation messages broadcast to California residents since the energy crisis of 2001. Three program categories are separated: the RECAP Mail-in participants, the RECAP Online participants (SCE), and the SDG&E Online participants.

A factor analysis was completed on these seven items, and two orthogonal factors emerged. One factor consisted of two items that pertain to negative attitudes about personal ability to conserve: "My life is too busy to worry about making energy-related improvements in my home," and "There is very little I can do to reduce the amount of electricity I am now using." The others reflect more general or abstract attitudes about conservation. One of the questions was unique to this study because it concerned attitudes about the California energy crisis of 2001. However, that item loaded with the other general conservation attitudes.

The items concerning personal limitations were not strongly endorsed by any group. On a scale of 1 to 10, the midpoint is 5, and all of the mean scores for these items are substantially below that midpoint. For the first item, a statement about being too busy to think about

energy efficiency, California residents hold these attitudes slightly more strongly than the country at large, and program participants of all types were less likely than the rest of California to endorse them, especially the Online participants. In response to the statement that there is little one can do to conserve, the audit participants, especially RECAP Mail-In participants, report holding this attitude more strongly than either the United States as a whole, or the rest of California. This might be due to the aggressive conservation efforts of the California utilities over the last 20 years, especially since the most recent energy crisis in 2001.

Considering the more abstract attitudes, overall, these are much more highly endorsed; all means are over 6, but participants tend to be a little higher than the general population. California residents are slightly lower in conservation attitudes than the rest of the country. The item on the belief in the scarcity of energy in the future yielded higher endorsement in participants than in the general population, but the opposite is true for the belief that one should use less energy to avoid building new power plants. This belief is held less strongly by our participants than by the general population. For the rest of the items, the RECAP participants were more conservation-oriented than the rest of the population, and the SDG&E online group was about the same as the general population.

The final item, not addressed in previous studies, concerned belief in the value of conservation during the 2001 California energy crisis. Overall, the participants rated this item substantially higher than the midpoint, with the RECAP participants being higher than the SDG&E Online program participants.

Table 4-16
Comparison of Mean Conservation Attitudes by U.S. Respondents, California Respondents, and Audit Type

Item	U.S. Respondents	California Respondents	RECAP Mail-In (Weighted)	RECAP Online (SCE)	SDG&E Online
My life is too busy to worry about making energy-related improvements in my home.	3.38	3.70	3.34	3.11	3.17
Scarce energy supplies will be a major problem in the future.	7.13	6.89	7.53	7.53	7.50
Instead of building new power plants, customers should use less electricity.	6.32	6.24	5.89	5.99	4.87
It is possible to save energy without sacrificing comfort by being energy efficient.	7.86	7.69	7.81	8.07	7.61
It is worth it to me for my household to use less energy in order to help preserve the environment?	7.69	7.71	8.09	7.95	7.62
Conservation efforts helped reduce the effects of the energy crisis during the summer of 2001.	n/a	n/a	7.10	7.53	6.67
Conserving energy in my home is an economic necessity.	7.15	6.79	7.49	7.89	7.42
There is very little I can do to reduce the amount of electricity I am now using.	4.78	4.85	5.80	5.66	5.24

Note: Responses ranged from 1 to 10, with 10 being strongest agreement with the statement

4.5 Program Satisfaction

Seven questions measuring program satisfaction were asked of all participants, and an extra question was asked of the Online participants, pertaining to their overall impression of the web site. Separate sets of mean ratings are shown in Table 4-17 for the RECAP Mail-in, the RECAP Online, and the SDG&E Online program participants. This allows a comparison between the two surveys (RECAP versus ENERCOM) and between two means of delivering the same survey and report (Online versus Mail-in for the RECAP survey). We first present the level of satisfaction for all participants. We then compare the level of satisfaction of the HTR participants to that of the non-HTR participants.

4.5.1 Satisfaction of All Participants

The rating scale used for this part of the survey was from 1 to 5, with five being the most favorable. The midpoint is, of course, 3 in this case. All ratings for each aspect of the survey and report were above the midpoint so that the favorable responses outweighed the unfavorable. In fact, there is little to differentiate the ratings of any of the items. The ratings range only from 3.16 to 3.29 for the RECAP Mail-in Audit and between 3.22 and 3.41 for the RECAP Online program. This also implies that the means of program delivery, per se, is not an important factor in satisfaction, although there is a slight tendency for the Online participants to give more favorable ratings. On the other hand, the Online participants to the SDG&E ENERCOM survey provide noticeably higher ratings than the other two types of participants. There is not a wide spread of opinion across the items for this group of participants either. The ratings range between 3.86 and 4.27. The participants in this program were clearly somewhat more satisfied than those in the other program. The overall impression of the site was the highest rating at 4.27, followed by the ease of use, which was rated at 4.15. The lowest rating for all three groups was for the item “The recommendations in the energy survey report were relevant to my house.”

Table 4-17
Satisfaction with the Program

Satisfaction Question	Measure*	RECAP Mail-in	RECAP Online (SCE)	SDG&E Online
How would you rate your overall impression of the site?	Mean	NA	3.31	4.27
	S.D.	NA	0.620	0.560
The form/web site was easy to use.	Mean	3.26	3.31	4.15
	S.D.	0.479	.580	0.675
The amount of time to complete the energy survey was about right.	Mean	3.20	3.23	3.95
	S.D.	0.497	0.516	0.782
The energy survey report was delivered to me in a timely manner.	Mean	3.22	3.41	3.98
	S.D.	0.573	0.593	0.875
The energy survey report was easy to understand.	Mean	3.29	3.45	4.01
	S.D.	0.525	0.565	0.936
The recommendations in the energy survey report were relevant to my house.	Mean	3.16	3.22	3.86
	S.D.	0.645	0.846	0.975
The information contained in the energy survey report was informative.	Mean	3.29	3.25	4.00
	S.D.	0.555	0.704	0.857
In general, the energy savings associated with the recommendations were believable.	Mean	3.22	3.26	3.92
	S.D.	0.579	0.739	0.790

*Ratings were from 1 to 5, with 5 being most favorable

4.5.2 Satisfaction of HTR versus Non-HTR Participants

The satisfaction with the program of the HTR groups compared to their corresponding non-HTR participants (defined by ZIP codes) is depicted in Table 4-18. This table allows us to see if the HTR participants have a different view of the program than the traditional participants. However, there are very few cells where any substantial difference in satisfaction can be seen between these two groups. Where there are small differences, they do not form a pattern, e.g., HTR being higher or lower in satisfaction. The clear conclusion is that, to the extent that those in HTR ZIP codes represent true HTR customers, they do not differ in their views of the HEES Program.

Table 4-18
Mean Satisfaction by HTR Status by Utility

Hard-to-Reach Category	Group	PG&E Mail	SCG Mail	SCE Mail	SCE Online	SDG&E Mail	SDG&E Online
Renters	HTR	3.26	3.29	3.19	3.31	3.06	4.01
	Non-HTR	3.25	3.19	3.26	3.23	3.22	4.02
Rural	HTR	3.20	3.08	3.37	3.42	3.10	4.42
	Non-HTR	3.27	3.26	3.20	3.24	3.18	4.00
Moderate Income	HTR	3.25	3.16	3.26	3.38	3.14	3.95
	Non-HTR	3.25	3.25	3.22	3.21	3.20	4.03
Hispanic/Latino	HTR	3.45	3.29	3.28	3.23	3.10	3.89
	Non-HTR	3.21	3.20	3.21	3.28	3.23	4.04

4.6 Reaching the Hard-to-Reach

In this section, we assess utility efforts to contact the hard-to-reach population. We begin with an examination of utility claims that they met their direct mail solicitation for the HTR customers. We then proceed to analyze the characteristics of the ZIP codes where the mailings were targeted. The characteristics that we considered were those that comprise the HTR definitions provided by the CPUC. The methods used to characterize the ZIP codes are described below; they can be defined in varying degrees of restrictiveness. For this analysis, we used *both* less and more restrictive definitions. Using these definitions, we then matched the 559,762 ZIP codes that received direct mail solicitations to the ZIP codes identified as HTR. This analysis provides a kind of "sanity check" on the different methods used by utilities for reaching the hard-to-reach.

Next, we conducted an overall assessment of participation by examining the geographical distribution of all participants and HTR participants. We then focus on the HTR participation rates, followed by an analysis of first-time HTR participants. Finally, we address the efficiency of the ZIP Code system of targeting HTR. In other words, have the strategies employed during PY2002 been successful in increasing participation of hard-to-reach customers compared to prior years?

Our classification of the HTR ZIP codes relied on the Statewide Residential Needs Assessment Study (Reed, et al., 2001). As described earlier in Section 2.4, because 1990 decennial Census data were considered out of date, other sources, such as a dataset produced by Claritas called PRIZM, were used to locate and analyze the populations of interest. PRIZM defines the American population in terms of 62 segments. To identify the HTR customers, they developed 27 HTR segments and assigned a score of 0 to 4 to reflect the extent to which each ZIP code could be characterized as HTR. Finally, they mapped each of these 27 segments into the five criteria that the CPUC has established for defining the HTR population:

1. Language: Primary spoken language is other than English
2. Income: Those customers who fall into the moderate income level

3. Housing Type: Multi-family and mobile home tenants
4. Geography: Residents of areas other than the San Francisco Bay area, San Diego area, Los Angeles Basin, or Sacramento
5. Tenure: Renters

For example, a ZIP code was assigned a renter score of 1 if it received a score of 4 on at least one of the 10 segments associated with renters. If it did not score a 4 on any of the 10 criteria, we assigned it a score of zero. (Note that the criterion *housing type* was combined with Tenure.) Using this approach, we assigned to each ZIP code a score of 1 or zero for the remaining three HTR criteria for language, income, and geography. Each ZIP code could qualify as HTR by meeting one or more of the four criteria. We also created a somewhat less restrictive definition of HTR by requiring a score of 3 or above for a ZIP code to receive a score of 1.

To capture the intensity with which a ZIP code met the four criteria, we used the more restrictive definition and summed the scores for all four criteria for each ZIP code. Thus, a ZIP code could have been assigned a score of 0 if it met none of the four criteria or a number greater than 0 if it met one or more of the four criteria. Each participant was categorized as to whether or not they lived in a ZIP code with the highest prevalence of each hard-to-reach variable.

4.6.1 Direct Mail Solicitations

The results of our analysis regarding utility direct mail solicitation efforts with respect the HTR customers are encouraging. Table 4-19 present these results.

Table 4-19
Direct Mail Solicitations and HTR Achievement, by Utility

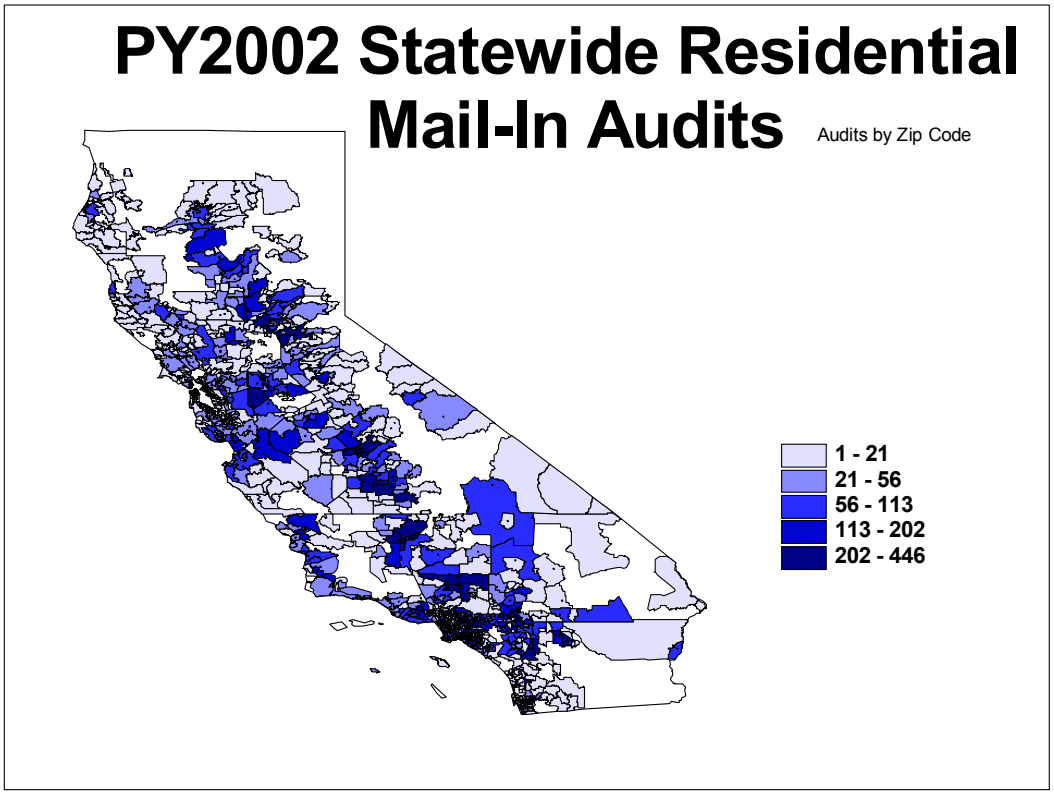
Utility	Direct Mail Solicitations	HTR Achievement: Most Restrictive Definition	HTR Achievement: Less Restrictive Definition
PG&E	219,880	76%	88%
SCE	264,853	71%	90%
SoCalGas	56,576	73%	94%
SDG&E	18,453	49%	97%
Total	559,762		

Using both the restrictive and the less restrictive definitions of a HTR ZIP code, all four utilities essentially met or exceeded their goal of 50 percent.

4.6.2 Geographic Distribution of All Participants and HTR

The success of the various outreach efforts for the Mail-In Audit can be measured in a number of ways. Using the ZIP codes for the participants in the Mail-In Audit, the SCE, PG&E Online Audit, and SDG&E Online Audit, we developed a series of maps. We begin with the statewide participation in the Mail-In Audit presented in Figure 4-4.

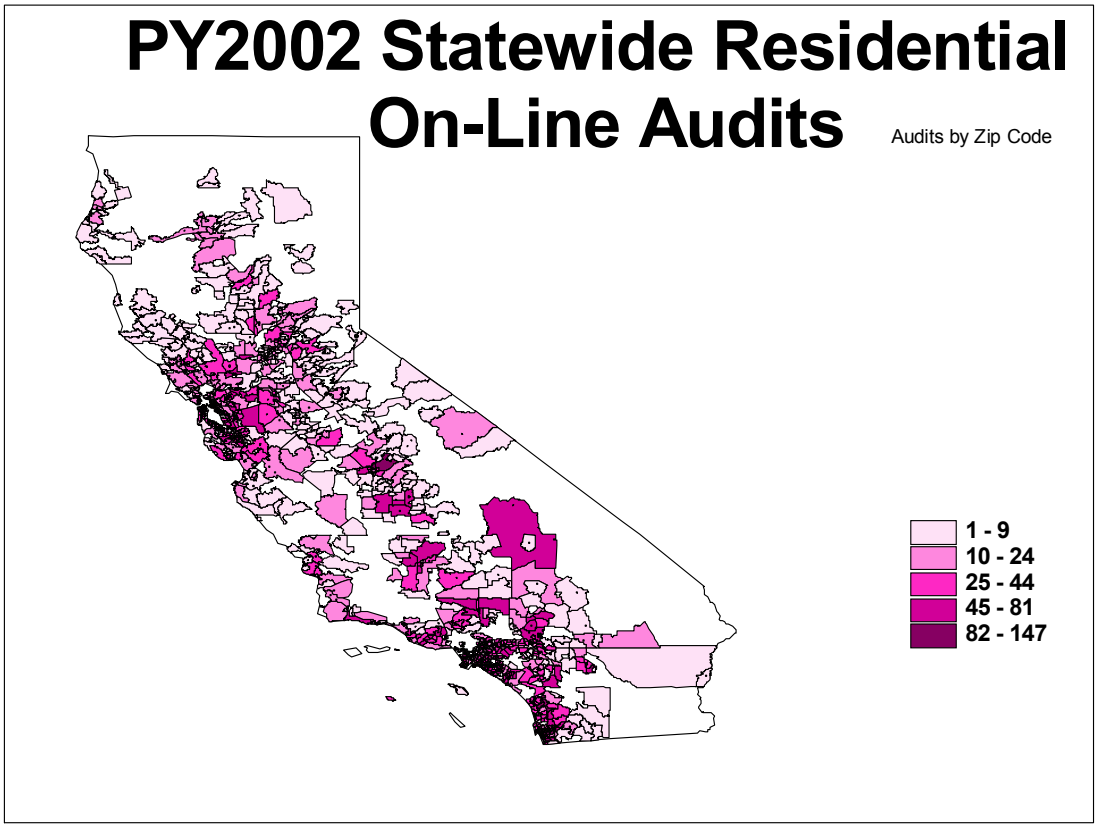
Figure 4-4
Participation in the Statewide Mail-In Audit



As one can see, a very large portion of the utility service territories appears to have been reached by the Mail-In Audit outreach effort. Utility-specific maps are provided in Appendix K.

In Figure 4-5, we present the statewide participation in the Online Audit, by utility. Utility-specific maps are also provided in Appendix K. Again, it is clear that a very large portion of the utility service territories appears to have been reached by the Online Audit.

Figure 4-5
Participation in the Statewide Mail-In Audit, by Utility



4.6.3 HTR Participation Rates

In this section we present the results of two different analyses based on the variables described in Section 0. The first looks at participation rates within those ZIP codes that were defined as HTR using the four criteria. The second looks at participation rates within those ZIP codes that were defined in terms of HTR intensity from zero (met none of the HTR criteria) to 4 (met all of the HTR criteria).

Table 4-20 presents the percent of Mail-In Audit participants by HTR criteria by utility. Table 4-21 shows the percent of audit participants that fell into each HTR intensity level by utility.

Table 4-20
Percent Mail-In Participation, by HTR Criteria, by Utility

Hispanic/ Latino	Moderate Income	Renter	Rural	Hispanic/ Latino
PG&E	17.9%	45.6%	30.6%	35.6%
SCE	34.8%	32.8%	36.9%	17.2%
SDG&E	34.5%	30.6%	24.4%	3.2%
SoCalGas	33.6%	29.0%	38.3%	16.1%

Table 4-21
Percent Mail-In Participation, by HTR Intensity, by Utility

	HTR Intensity				
Utility	0	1	2	3	4
PG&E	22.6%	37.3%	28.3%	11.5%	0.3%
SCE	30.4%	34.8%	19.9%	12.5%	2.4%
SDG&E	50.6%	19.2%	17.1%	13.1%	0.0%
SoCalGas	31.6%	36.1%	17.5%	13.2%	1.6%

As one can see from Table 4-20, the participation by customers who live in ZIP codes that meet the various HTR criteria is high. From Table 4-21, we can see that, except for SDG&E, the majority of ZIP codes represented by program participants met at least one of the four HTR criteria.

Table 4-22 and Table 4-23 present the percent of Online Audit participants by HTR criteria and HTR intensity, by utility.

Table 4-22
Percent Online Participation, by HTR Criteria, by Utility

Utility	Hispanic/ Latino	Moderate Income	Renter	Rural
PG&E	12.2%	26.9%	40.1%	16.2%
SCE	25.4%	25.3%	37.8%	13.2%
SDG&E	20.5%	34.5%	38.7%	2.4%

Table 4-23
Percent Online Participation, by HTR Intensity, by Utility

	HTR Intensity				
Utility	**0**	**1**	**2**	**3**	**4**
PG&E	35.7%	40.8%	16.3%	6.9%	0.3%
SCE	36.2%	36.5%	17.7%	8.3%	1.2%
SDG&E	33.0%	44.7%	15.5%	6.8%	0.0%

From Table 4-22, it is clear that the participation by customers who live in ZIP codes that meet the various HTR criteria is high. From Table 4-23, we can see that, for all three utilities, the vast majority of ZIP codes met at least one of the four HTR criteria.

Figure 4-6 and Figure 4-7 confirm what we saw in Table 4-20 through Table 4-23 Geographic coverage of the HTR ZIP codes appears to be fairly good with many of the ZIP codes meeting at least one of the HTR criteria. Utility-specific maps are provided in Appendix L.

Figure 4-6
HTR Intensity for Mail-In Audit, by Utility

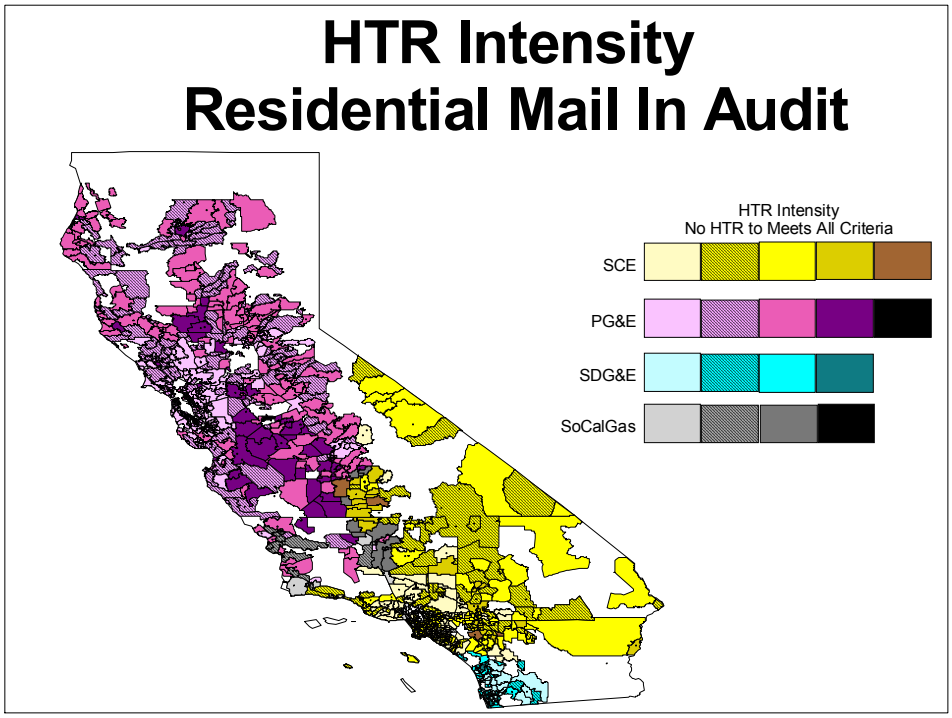
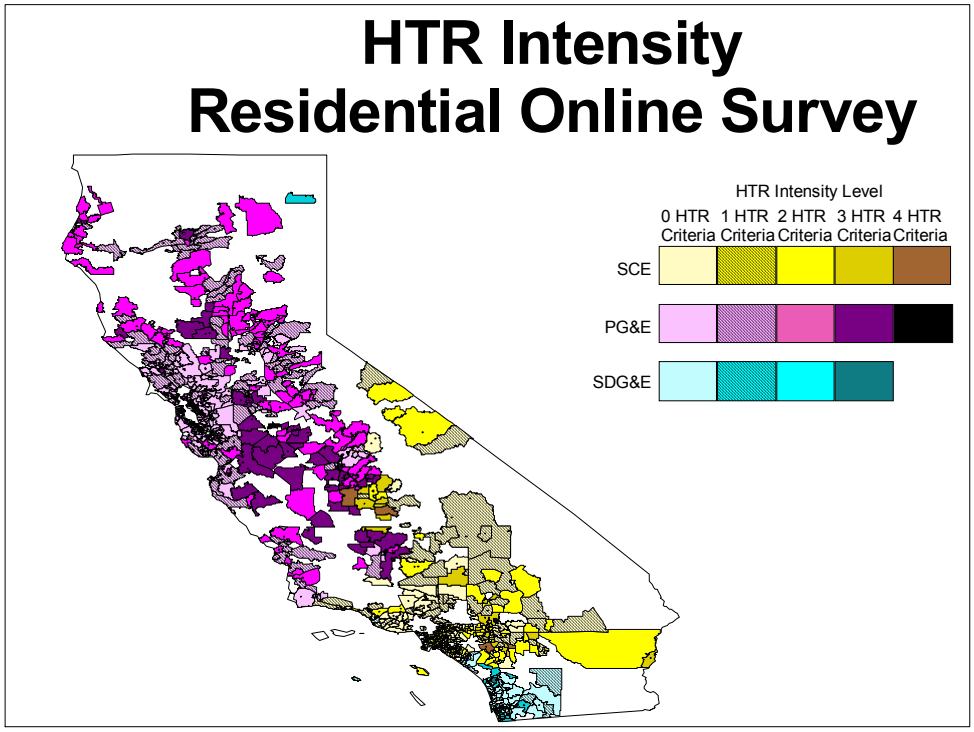


Figure 4-7
HTR Intensity for Online Audit, by Utility



Now we present another way of assessing the participation of HTR customers. Based on the interviewed sample, Table 4-24 shows what percentage of each program group consisted of participants living in a high hard-to-reach ZIP code, using the four definitions of hard-to-reach described above. Though some variation across hard-to-reach categories and across utility programs is clear, it is hard to interpret the meaning of these differences given that the different utility territories vary in the prevalence of these hard-to-reach categories as well. To help with the interpretation of these patterns, an analysis was completed and portrayed in Table 4-25.

Table 4-24
Percent of Participants in Each of Four Hard-to-Reach Categories by Utility/Program

Hard-to-Reach Category	PG&E Mail	SCG Mail	SCE Mail	SCE Online	SDG&E Mail	SDG&E Online
Renter	34.2%	42.1%	38.7%	44.7%	27.6%	45.5%
Rural	34.2%	17.1%	21.3%	14.5%	3.9%	3.3%
Moderate Income	52.6%	25.0%	40.0%	32.9%	35.5%	24.0%
Hispanic/Latino	15.8%	31.6%	34.7%	32.9%	39.5%	16.5%

This table shows the percent of *all ZIP codes in each territory* that have a high prevalence of each of the four hard-to-reach groups, using the same criteria for high prevalence that was used in Table 4-24. To combine the information in the two tables, the percentage of participants who live in ZIP codes high in the hard-to-reach category seen in Table 4-24 (e.g., 34.2 percent of PG&E Mail-in participants live in ZIP codes with high rental rates) was divided by the corresponding cell of Table 4-25 (e.g., 16.5 percent of ZIP codes having high rental rates in the PG&E territory).

Table 4-25
Percent of Each Territory's ZIP Codes that are High in Each Hard-to-Reach Category

Hard-to-Reach Category	PG&E	SCG	SCE	SDG&E
Renter	16.5%	33.7%	26.9%	31.8%
Rural	30.1%	18.3%	21.4%	3.6%
Moderate Income	21.1%	15.7%	17.2%	9.1%
Hispanic/Latino	18.4%	38.9%	33.0%	16.2%

By using the figures in Table 4-25 as divisors, we do not imply that the numbers from Table 4-24 are equivalent to those in Table 4-25; they are not. However, this ratio allows us to look at the participant percentages in a context, or in comparison to an index of sorts.

Table 4-26 and Figure 4-8 present these ratios. Here we see that PG&E's rate of participants in high-rental-rate ZIP codes is 2.07 times higher than the percentage of high-rental-rate ZIP codes in that territory (34.2 percent /16.5 percent=2.07), while the analogous ratio for Hispanic/Latino participants in that program is 0.85 (15.8 percent/18.4 percent=0.85). This difference could be interpreted as evidence that the PG&E Mail-in program has been somewhat more successful in targeting renters than it has Hispanics.

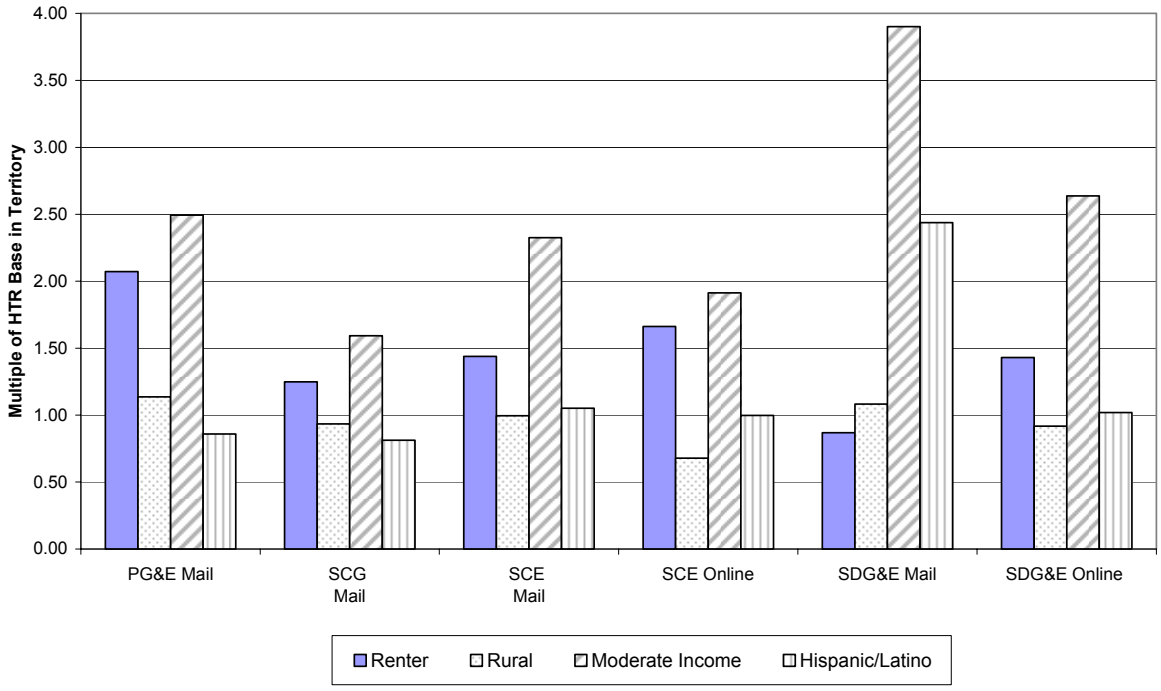
Table 4-26
Percent of Participants in Each Hard-to-Reach Categories Divided by Percent of Each Territory's ZIP Codes That are High in Hard-to-Reach by Utility/Program, by HTR Category

Hard-to-Reach Category	PG&E Mail	SCG Mail	SCE Mail	SCE Online	SDG&E Mail	SDG&E Online
Renter	2.07	1.25	1.44	1.66	0.87	1.43
Rural	1.14	0.93	1.00	0.68	1.08	0.92
Moderate Income	2.49	1.59	2.33	1.91	3.90	2.64
Hispanic/Latino	0.86	0.81	1.05	1.00	2.44	1.02

The picture this provides is that all programs were the most successful in penetrating the moderate-income residences. More specific findings were that the SDG&E Mail-in Program has been most successful in targeting moderate-income residents and Hispanics, while the PG&E Mail-in Program has been most successful in targeting renters.

Next, in Figure 4-6 and Figure 4-7, we map all the participants in the Mail-In and Online Audits across all four utilities with respect to HTR intensity. This allows one to better visualize what the previous tables attempted to demonstrate.

Figure 4-8
Percent of Participants in Hard-to-Reach ZIP Codes
Divided by Percent of Utility ZIP Codes High in HTR



4.6.4 Hard-to-Reach as First-Time Participants

A final approach to assessing the success in increasing penetration into hard-to-reach markets in a specific program year compared to previous years is to analyze the characteristics of the first-time participants compared to those who have participated in other programs in prior years. In other words, have the strategies employed during PY2002 been successful in increasing participation of hard-to-reach customers compared to prior years? If the answer is yes, there should be a stronger presence of the hard-to-reach among those who have not participated before, as compared to their presence in the group who have participated before. By way of background information, Table 4-27 shows the overall percentage of participants who have not participated in programs in prior years.

Table 4-27
Percent of Each Utility/Program
That Has Not Participated in Past Programs

Utility/Program	Percent
PG&E Mail	85.5%
SCG Mail	76.3%
SCE Mail	76.0%
SCE Online	84.2%
SDG&E Mail	81.6%
SDG&E Online	71.9%

The overall percentage of first-time participants is high. Section 4.6.5 showed that some hard-to-reach groups are over-represented in some territories, e.g., the SDG&E Mail-in Program looked most successful in targeting moderate-income residents and Hispanics, while the PG&E Mail-in Program appeared most successful in targeting renters. However, it could be that these penetration rates are the result of a long-term trend rather than due to this year's particular strategies. To focus on the current year's efforts, the question we ask now is how the hard-to-reach participants are distributed; specifically, what percent of them are first-time participants versus what percent have participated in other programs? Table 4-28 helps to answer that question.

Table 4-28
Percent of Hard-to-Reach Participants Who Have and Have Not Participated in Past Programs, By Utility/Program

Hard-to-Reach Category	Response	PG&E Mail	SCG Mail	SCE Mail	SCE Online	SDG&E Mail	SDG&E Online
Renter	Part in Past	27.3%	38.9%	33.3%	41.7%	21.4%	35.3%
	No Past Part	35.4%	43.1%	40.4%	45.3%	29.0%	49.4%
Rural	Part in Past	36.4%	38.9%	16.7%	25.0%	14.3%	8.8%
	No Past Part	33.8%	10.3%	22.8%	12.5%	1.6%	1.1%
Moderate Income	Part in Past	36.4%	27.8%	38.9%	33.3%	28.6%	17.6%
	No Past Part	55.4%	24.1%	40.4%	32.8%	37.1%	26.4%
Hispanic/Latino	Part in Past	0.0%	27.8%	33.3%	33.3%	35.7%	5.9%
	No Past Part	18.5%	32.8%	35.1%	32.8%	40.3%	20.7%

To some extent, similar patterns can be seen in this analysis as were seen in the earlier HTR analysis (see Figure 4-8). In PG&E territory there was a somewhat higher percentage of renters among the first-time participants than among the past participants, and the same is true for the SDG&E Mail-in Program as well; also, in the SDG&E Mail-in Program, moderate income and Hispanic participants are slightly over-represented in the first-time group compared to their representation among past participants. These effects are small, suggesting that the trends we saw above were at least partly due to past program strategies. The large effects in this analysis are among the moderate income (55.4 percent versus 36.4 percent) and Hispanic (18.5 percent versus 0 percent) groups for the PG&E Mail-in Program,

and the renters (49.4 percent versus 35.3 percent) and Hispanics (20.7 percent versus 5.9 percent) in the SDG&E Online Program. These effects may be new and may not have been sufficiently incremented over the years to be seen in the type of analysis done in Section 4.6.3.

While targeting by HTR ZIP codes appears to have worked reasonably well, the analysis in the following section shows that it is imperfect.

4.6.5 The Efficiency of ZIP Code Targeting

ZIP codes are established by the United States Postal Service for efficient mail delivery (ZIP is a coined acronym which stands for Zone Improvement Plan). Because ZIP code boundaries follow the routes of mail carriers, they do not conform to boundaries of Governmental Units or to those of the Bureau's Statistical Units. In fact, ZIP code areas usually do not have clearly identifiable boundaries. They change periodically to meet postal requirements and they do not cover the total land area of the United States. For these reasons, Census Bureau geographers would prefer to ignore ZIP Code Areas, despite their popularity among direct mail marketers and other data users.

Because the area defined by a ZIP code is comprised of smaller units called tracts and block groups, ZIP codes manifest greater variation with respect to demographic characteristics than do the smaller units such as tracts. Thus, targeting by ZIP code areas is less refined than targeting by tracts or block groups. To illustrate this problem, we examine the demographic characteristics of participants who live in ZIP codes that have been defined as HTR (moderate income, Latino/Hispanic, or renter). For example, a person who lives in a ZIP code that has been defined as Moderate Income and whose self-reported income based on the telephone survey falls in the moderate income category is declared as being accurately targeted. On the other hand, a person who lives in a ZIP code that has been defined as Moderate Income and whose self-reported income does not fall in the moderate income category is declared as being inaccurately targeted. Table 4-29 presents these results.

Table 4-29
Error Rates Using ZIP Code Targeting

HTR Group	Error Rates
Moderate Income	69.5%
Latino/Hispanic	87.2%
Renter	86.4%

As we can see, the error rates are all quite large. Targeting through the use of demographic data at the Census tract level would likely produce smaller errors, i.e. more efficient marketing.

4.7 Recall and Pre-Program Awareness of Recommendations

An important question is the extent to which program participants were able to recall each of the measures and practices recommended and the extent to which they were aware of benefits of these measures and practices prior to the audit. Table 4-36 presents the overall results, while Table 4-31 and Table 4-32 present these results by measures versus practices.

Table 4-30
Summary Statistics on Recommendations, Recall, and Awareness,
By Utility/Program

Variable		PG&E Mail	SCG Mail	SCE Mail	SDG&E Mail	Overall Mail (Wgted)	SCE Online
# Recommendations	Mean	7.51	5.62	5.01	4.64	6.13	5.88
	SD	1.28	1.52	1.91	2.10	2.03	2.53
% Recs Recalled	Mean	0.70	0.63	0.80	0.59	0.73	0.67
	SD	0.32	0.39	0.30	0.42	0.33	0.40
% Aware of Benefit	Mean	0.79	0.78	0.83	0.90	0.86	0.85
	SD	0.22	0.27	0.20	0.14	0.18	0.20

Table 4-31
Summary Statistics on Recommendations, Recall, Awareness, By Utility/Program:
Measures

Variable		PG&E Mail	SCG Mail	SCE Mail	SDG&E Mail	Overall Mail (Wgted)	SCE Online
# Recommendations	Mean	5.21	2.79	4.25	3.26	4.46	5.28
	SD	1.21	1.33	1.55	1.41	1.59	2.09
% Recs Recalled	Mean	0.66	0.61	0.75	0.54	0.69	0.64
	SD	0.33	0.42	0.31	0.43	0.34	0.41
% Aware of Benefit	Mean	0.77	0.78	0.82	0.88	0.80	0.86
	SD	0.24	0.32	0.23	0.20	0.24	0.21

Table 4-32
Summary Statistics on Recommendations, Recall, Awareness, and Adoptions
By Utility/Program:
Practices

Variable		PG&E Mail	SCG Mail	SCE Mail	SDG&E Mail	Overall Mail (Wgted)	SCE Online
# Recommendations	Mean	2.30	2.83	0.76	1.38	1.66	0.61
	SD	1.35	0.85	0.82	1.14	1.36	0.83
% Recs Recalled	Mean	0.75	0.59	0.85	0.64	0.75	0.64
	SD	0.38	0.42	0.35	0.47	0.39	0.47
% Aware of Benefit	Mean	0.85	0.79	0.85	0.94	0.85	0.84
	SD	0.29	0.33	0.35	0.20	0.32	0.36

Approximately one year after the audit, the vast majority were able to recall the specific recommendations. This is consistent with the fact that the vast majority of the participants were satisfied that:

- The energy survey report was easy to understand.
- The recommendations in the energy survey report were relevant to my house.
- The information contained in the energy survey report was informative.
- In general, the energy savings associated with the recommendations were believable.

In addition, the vast majority of participants were already largely aware of the benefits of both measures and practices prior to the audit. Again, this might be partly due to recent experience with the energy crisis of 2001 and the massive energy efficiency campaign launched by the California utilities and regulatory agencies.

Another measure of awareness is the extent to which participants had ever heard of ENERGY STAR®. Table 4-33 presents these results.

Table 4-33
Awareness of ENERGY STAR®

Condition	PG&E Mail-In	SDG&E Mail-In	SoCalGas Mail-In	SCE Mail-In	SCE Online
Percent Aware Without Prompt	74%	46%	47%	52%	68%
Percent Aware With Prompt	82%	73%	72%	73%	86%

Clearly, many of the respondents had heard of ENERGY STAR®, with the percent aware ranging from 46 percent to 86 percent. After reminding respondents of the meaning of ENERGY STAR®, these percentages rose substantially, ranging from 72 percent to 86 percent.

Next, we asked whether respondents whether they were aware of any utility-sponsored energy conservation programs, other than the Mail-In or Online Audits. In Table 4-34, we can see that less than 50 percent of the respondents across all utilities and audit types were aware.

Table 4-34
Awareness of Utility-Sponsored Energy Conservation Programs, by Utility and Audit Type

Utility	Audit Type	Percent Aware
PG&E	Mail-In	25%
SCE	Mail-In	37%
SoCalGas	Mail-In	42%
SDG&E	Mail-In	30%
SCE	Online	33%

Of those who claimed to be aware, we then probed to determine the general type of utility-sponsored programs. Table 4-35 presents these results.

Table 4-35
Awareness of Specific Utility-Sponsored Programs, by Utility and Audit Type

Program	PG&E Mail-In	SDG&E Mail-In	SCG Mail-In	SCE Mail-In	SCE Online
Rebates	53%	35%	56%	36%	48%
Product Give-Away/Turn-In Event	0%	17%	3%	4%	0%
Refrigerator Turn-In/Recycling	0%	17%	13%	11%	16%
Home Repair/Retrofit	21%	13%	28%	11%	12%
Energy Survey Delivered On-Site	5%	9%	0%	4%	4%
Other	47%	39%	31%	50%	44%
Refused	5%	0%	3%	4%	4%

Note: Percentages are based on participants, not responses, and more than one response was possible, so the percents add up to more than 100.

On average, less than half of the respondents indicated that they were aware of rebate programs followed by the refrigerator recycling program. If one of the goals of the HEES Program is to serve as a feeder program into resource acquisition programs, then much more needs to be done to market utility-sponsored programs.

4.8 Adoption of Recommendations

A critical measure of the success of an energy-efficiency program, especially an information program, is the extent to which participants adopted the recommendations made. The participants were asked in the interview whether they had adopted the audit recommendations. Based on answers to these questions, summary statistics for each program-utility, and a weighted average were separately produced for all recommendations as well as for measures and practices. Table 4-36 depicts the summary figures for total recommendations, as well as measures versus practices.

Table 4-36
Summary Statistics on Recommendations Adopted Overall and by Measures Versus Practices, By Utility/Program

Variable		PG&E Mail	SCG Mail	SCE Mail	SDG&E Mail	Overall Mail (Wgted)	SCE Online
% Adopted: Overall	Mean	0.41	0.40	0.54	0.44	0.47	0.43
	SD	0.20	0.26	0.27	0.29	0.25	0.27
% Adopted: Measures	Mean	0.34	0.25	0.56	0.31	0.45	0.35
	SD	0.25	0.33	0.30	0.34	0.29	0.30
% Adopted: Practices	Mean	0.44	0.40	0.32	0.45	0.44	0.40
	SD	0.36	0.33	0.43	0.44	0.39	0.47

Overall, the weighted Mail-In adoption rate is 47 percent with the SoCalGas Mail-In Audits having the lowest rate at 40 percent and the SCE Mail-In Audits having the highest rate at 54 percent. The Mail-In adoption rate for measures is slightly higher than that for practices, 45 percent and 44 percent, respectively. Finally, the adoption rate for the SCE Audit is lower overall as well as for measures versus practices than the Mail-In Audit. These adoption rates were consistent with rates found by Ridge (2001).

4.8.1 Adoption Rates by Fuel Type

Table 4-37 shows the adoption ratios for electricity and gas recommendations. These numbers have to be interpreted in the context of the nature of the data on which they are based. As indicated elsewhere in this report, a very substantial number of recommendations were not based on savings calculations; thus, these recommendations had no savings recorded. Since the fuel type associated with recommendations and adoptions could only be determined on the basis of actual savings recorded, rates of adoption could not be calculated except on those recommendations for which savings were recorded. As a result, the figures reported in Table 4-37 represent only a subset of the recommendations. Nevertheless, they were thought to be useful enough to report here.

Table 4-37
Adoption Rates by Fuel Type by Utility (Unweighted)
And Statewide (Weighted)

		Fuel Type	
	Audit Type	Electric	Gas
PG&E	Mail-In	0.32	0.50
SCE	Mail-In	0.32	n/a
SoCalGas	Mail-In	n/a	0.46
SDG&E	Mail-In	0.36	0.38
SCE	Online	0.33	n/a
Statewide		0.32	0.47

The most prominent patterns observed in this table are the homogeneity of the adoption rates for recommendations involving electricity savings, and the fact that the corresponding gas savings recommendation adoption rates are uniformly higher than the electricity-related adoptions.

4.8.2 Adoption Rates for HTR Participants

One question is whether there is any difference between the HTR and the non-HTR participants with respect to adoption rates. Table 4-38 presents these results. It is interesting that there appear to be no statistically significant differences in the overall adoption rates between the HTR and non-HTR populations. However, an examination of the rates for the moderate income group reveals a tendency for the HTR participants to be more likely to adopt practices and for the non-HTR participants to be more likely to adopt measures. This

could be explained by the fact that the adoption of measures requires an expenditure of money while the adoption of practices requires no expenditures.

Table 4-38
Adoption Rates, by Measures versus Practices, by Utility, by Audit Type

	Measures		Practices	
HTR Category/Utility Program	**HTR**	**Non-HTR**	**HTR**	**Non-HTR**
Renters				
PG&E	0.40	0.36	0.38	0.53
SCE	0.60	0.56	0.38	0.31
SoCalGas	0.33	0.24	0.54	0.48
SDG&E	0.42	0.35	0.55	0.52
SCE Online	0.37	0.47	0.54	0.45
Rural				
PG&E	0.39	0.37	0.47	0.48
SCE	0.63	0.57	0.44	0.32
SoCalGas	0.24	0.29	0.47	0.51
SDG&E	0.31	0.38	0.33	0.53
SCE Online	0.43	0.43	0.50	0.48
Moderate Income				
PG&E	0.37	0.38	0.50	0.45
SCE	0.57	0.58	0.52	0.22*
SoCalGas	0.32	0.27	0.51	0.50
SDG&E	0.28	0.42	0.61	0.46
SCE Online	0.40	0.44	0.53	0.44
Hispanic/Latino				
PG&E	0.31	0.39	0.38	0.49
SCE	0.61	0.56	0.45	0.27
SoCalGas	0.30	0.27	0.50	0.51
SDG&E	0.41	0.35	0.59	0.47
SCE Online	0.38	0.45	0.50	0.48

*A p< .05 indicates statistical significance

4.8.3 Predicting Adoptions

Possibilities for program improvements could be suggested by the variables correlated with the adoption rates of participants. Table 4-39 presents a list of the variables that correlate with the percent of recommendations adopted, together with the size and significance of the correlation.

Table 4-39
Factors Associated with
Percent of Recommendations Adopted

Factor	Correlation Coefficient
Percent of recommendations participant recalled	.257*
Household Income	-.117
# Recommendations where participant was already aware of benefits	-.126*
The recommendations were relevant to my house.	.194*
My life is too busy to worry about making energy related improvements to my home.	-.092
Instead of building new power plants, customers should use less electricity.	.131*
It is possible to save energy without sacrificing comfort by being energy efficient.	.166*
It is worth it to me for my household to use less energy in order to help preserve the environment.	.225*
Conserving energy in my home is an economic necessity.	.109*
Mean of pro-conservation attitudes	.209*

*A P < .05 indicates statistical significance

The strongest associations with adoption rate are the percent of the recommendations that were recalled. Several conservation attitudes are also related, particularly agreement with the statement that it is worth it to use less energy to preserve the environment, followed by the overall mean of all seven conservation attitude statements. The statement that the participant is too busy to worry about making conservation improvements is, predictably, negatively related to adoption rate, although non-significantly. Finally, household income is somewhat correlated with adoption rate.

In an effort to determine the most efficient model for predicting adoption rate, a stepwise regression was estimated using the pool of items that were moderately or marginally related to adoption. The marginal variables were included in the pool because such variables can improve performance when other variables are included in the model. The results of this model are shown in Table 4-40. The model explains about 24 percent of the variance in adoption rate. The strongest predictor in the model is household income (negatively related), followed by percent of recommendations recalled. Also significantly related is the participants' rating of the statement that life is too busy to worry about improvements, and also the degree to which the recommendations made seemed relevant to the household. Each of these variables could have implications for the future in terms of targeting customer groups and program design. The income correlation suggests the wisdom of targeting moderate-income customers. The relation of recalling recommendations could suggest the importance of making recommendations memorable; corresponding to that could be the importance of designing the audit so that it customizes information to the home, since

irrelevant recommendations could be less memorable and make the report generally less believable. Finally, to the extent that being too busy to make energy improvements depresses adoption rates, it could be beneficial to link participants in this information program to other programs that could facilitate adoption, such as rebate programs, recycling programs, etc.

Table 4-40
Model Predicting Percent of Recommendations Adopted

Factor	B	S.E.	Beta
Constant	0.345*	0.113	
Household Income	-0.060*	0.013	-.351
Percent of recommendations participant recalled	0.245*	0.084	0.225
My life is too busy to worry about making energy related improvements to my home.	-0.016*	0.007	-.178
The recommendations were relevant to my house.	0.056*	0.028	0.155

*A $p<0.05$ indicates statistical significance; $R^2=0.235$

4.9 Energy Savings Analysis

4.9.1 PG&E Online Audit

PG&E's Online Audit is powered by Home Analyzer, the same audit tool employed by the Interactive Consumption and Cost Information Program's web site developed by PG&E on behalf of the CPUC. In 2002, PG&E contracted the services of Quantum Consulting and Socratic Technologies to measure the effectiveness of the Interactive Consumption and Cost Information Program's web site. The contractors produced a report[8] that thoroughly evaluates the web site and includes an evaluation of Home Analyzer's actionable recommendations on how respondents can save energy, along with an analysis of estimates of the level of savings that each recommendation can achieve. Because the PGE.com web site utilizes the same audit tools as the California Energy Connection web site and had experienced significantly more traffic at the time of the evaluation, the evaluation of Home Analyzer's recommendations was based on data obtained from PGE.com. The findings are summarized below; another evaluation of the PGE.com web site is not warranted for this current study.

The savings estimates generated by Home Analyzer were analyzed in a two-step approach. The end-use consumption estimates developed by the tool were first analyzed to ensure that the tool did not significantly over or under estimate usage. This enabled the analysis of savings estimates as a percentage of the end use consumption, which is much easier to evaluate, as these values are normalized.

4.9.1.1 End-Use Energy Consumption Analysis

In order to evaluate the end-use consumption estimates produced by the web site, a sample of nearly 10,000 residential audits was analyzed. The audits were developed by the Home

[8] Quantum Consulting and Socratic Technologies, "Interactive Consumption and Cost Information for Small Customers – Program Process/Customer Response Evaluation – Program Year 2002", February 27, 2003.

Analyzer audit tool for the PGE.com web site. Mean and median unit energy consumption (UECs) and energy usage intensities (EUIs) were generated for the residential end uses that were associated with energy saving measures recommended by the audit tools. These end uses/appliances included the following[9]:

1. Central Air Conditioners
2. Room Air Conditioners
3. Space Heaters
4. Water Heaters
5. Refrigerators
6. Second Refrigerators
7. Freezers
8. Clothes Washers
9. Dishwashers
10. Lighting
11. Hot Tubs
12. Pool Pumps
13. Water beds
14. Computers

To evaluate the audit's consumption estimates, the mean and median values of the UECs and EUIs were compared to PG&E's estimates, as reported in their current Residential Energy Survey Report.

4.9.1.2 UEC Comparison

First, the home size of the residential sample obtained from the audit was compared to PG&E's population to help understand differences that may occur between the samples. Overall, the audit home size was very similar to the PG&E home size (within 5 percent based on square footage bins).

Then the UECs estimated by the audit were compared with the PG&E values. The values compared well: of the 11 end uses for which comparisons could be made, 8 were within 14 percent. Those that had significant differences were the waterbeds and electric water heaters (although gas water heaters were within 9 percent). Both end uses have very low saturations, with only 8 percent of the population having an electric water heater and 8 percent having a waterbed, so these differences were not a major concern.

The only other difference of note was for the gas space heaters, for which the mean usage estimate from the audit was 22 percent less than the PG&E reported value. This difference may be attributed to the default value that the audit uses for daytime and nighttime thermostat set points, which we recommend the audit developer review for reasonableness.

Unfortunately, there were a few end uses that could not be compared. PG&E did not report UECs for clothes washers, lights or computers. Furthermore, the audit estimates the motor

[9] The audit did provide measure recommendations associated with a clothes dryer, but did not generate a UEC.

usage for dishwashing only, as opposed to PG&E, which estimates usage for both the motor and water heating. However, the audit results for these three end uses appear reasonable.

Overall, the UEC estimates compare well with the PG&E values and should provide a credible reference point from which savings estimates can be generated.

4.9.1.3 Energy Savings Review

The next step was to normalize the energy savings estimates generated by the audit tool, by dividing the energy savings estimate for each recommended measure by the relative annual consumption of end use (or end uses). Overall, the audit tool's savings estimates, expressed as a percentage of end use consumption, looked very credible. These savings estimates were compared to a variety of sources, such as PG&E's advice filings and program evaluations, Department of Energy reports, and the Consumer Guide to Home Energy Savings.

It is important to note that a few energy saving measures could not be evaluated adequately because the unit energy consumption was either missing, or only captured a portion of the total end use's consumption. In particular, there were no energy consumption values for clothes dryers; for dishwashers, only the motor usage was captured.

Overall, 25 percent of the measures that could be evaluated had savings estimated at 5 percent or less of the end use consumption, and 40 percent had savings estimated at 10 percent or less. Only one quarter of the measures were estimated to save over 25 percent of the end use consumption.

Only five measures were projected to save more that 50 percent. Of these five measures, two are very credible: the first is replacing a waterbed with a standard bed, which would save 100 percent of energy use. The second is turning off computers when not in use. It is important to note that this computer measure is generally only recommended to customers who leave their computers on overnight. The savings estimate is usually based on computer CPUs and monitors that had been left on all 8,760 hours of the year and were then reduced to running only a few hours a day. These conditions create an impact estimate that can exceed 1,000 kWh per computer, which make this measure one of the largest contributors to the overall potential savings. For example, over 1,000 audit recommendations were provided to 42 users who registered with the California Energy Connection site. Of these 1,000 recommendations, 16 were turning off computers when not in use. These 16 recommendations comprised 25 percent of the total savings across the 1,000 recommendations, even though they only comprised 1.6 percent of the number of recommendations.

The third measure with a high percent savings estimate is air-dry dishes; this measure's high percentage savings estimate can be explained based on the fact that the energy consumption (UEC) does not capture the heating element.

The last two high impact measures are replacing an air conditioner *or* an electric water heater with a high efficiency model. The typical savings estimate produced by the audit for air conditioners is 67 percent savings, which seems quite high. The audit estimates savings assume that a 14.1 SEER unit is installed, which is significantly higher than what most

consumers purchase, even when buying high efficiency equipment, and should be reviewed. Furthermore, even by installing a 14.1 SEER unit, a 67 percent savings is difficult to achieve.

For the electric water heater, the typical savings estimate produced by the audit is 53 percent, which assumes that the customer retrofits with a heat pump water heater. Due to the relatively high cost of heat pump water heaters, it may be more likely that the customer will install a conventional electric water heater, unless specifically directed to do so in the measure recommendation, which is not the case. If a customer replaces an old water heater with a more efficient one that is not a heat pump type, savings would be closer to 10 to 20 percent. The measure to replace a gas water heater with a more efficient model typically has a more reasonable savings estimate of 9 percent.

The only other measures with questionable savings estimates are one water heating measure, one cooling measure, and a few weatherization/shell measures. The water heating measure involves installing a heat recovery unit on the air conditioner or heat pump, which has a typical savings estimate of 39 percent of water heater usage. This seems rather high considering that for air conditioners savings can only be achieved during times when the air conditioner is used. Furthermore, the savings value of 39 percent often exceeds the entire estimated energy consumption of the air conditioner (exceeds air conditioner UEC 40 percent of the time). Typical savings for this measure are generally 10 percent or less. Compounding the problem of this overestimated savings value is the issue discussed above, the relatively high usage estimates for electric water heating.

The questionable cooling measure is increased use of the whole house fan, which is estimated as a negative impact, typically increasing usage by about 22 percent of the cooling usage. This measure is always associated with a negative savings estimate in the audit results. The audit assumes that the increased energy usage associated with the whole house fan is greater than the amount of energy savings associated with reduced central air conditioning. However, PG&E views this as an energy saving measure (not energy-increasing), estimated, in its 2002 program filing, to save 424 kWh per home. The report recommended that the web site stop recommending this measure to users.

The final three measures of concern are all weatherization/shell measures: replacing windows with energy efficient windows, caulking windows and doors, and improving attic, wall or foundation insulation. All three measures result in a positive heating impact, but a negative cooling impact. Essentially, these measures are increasing insulation or reducing infiltration. So, during the cooling season when the temperature outside is cooler than the temperature inside the home (e.g., at night and in the early morning), the home cannot release the heat that is captured inside and it uses more cooling load during the day to extract this heat. The audit estimates this cooling “penalty” to be greater than the cooling savings achieved during the day, which are created by these measures keeping the conditioned air inside the home and the hot air outside from entering. Frequently, customers naturally ventilate their homes at night by opening windows to allow the cool nighttime air into the home. This action reduces or eliminates the cooling “penalty,” resulting in the measures having a net positive cooling impact. The report recommended that this natural ventilation behavior be reviewed, and the cooling savings values be potentially revised for one or all of these measures. For example,

in its 2002 program filing, PG&E views insulation as an energy saving measure, estimated to save 0.13 kWh per square foot of insulation added.

Overall, the report found that the PGE.com web site was generating credible UECs for residential energy consuming end uses. With the exception of a few measures, Home Analyzer also produced reasonable values for the level of savings that could be achieved if customers implemented the actionable recommendations suggested by the web site.

4.9.2 Statewide Mail-In Audit and SCE Online Audit

The SCE Online home energy survey and all Mail-in surveys are powered by the RECAP audit tool. Our intent was to perform an analysis similar to that of the Home Analyzer: 1) analyze the end-use consumption to ensure that the tool does not significantly over or under estimate usage, and 2) analyze savings estimates as a percentage of the end use consumption. However, the RECAP data were not available in a sufficiently straightforward format to allow for completion of the analysis of savings within a reasonable period of time. That aspect of the RECAP tool should be the subject of a future analysis.

4.9.2.1 End-Use Energy Consumption Analysis

In order to evaluate the end-use consumption estimates produced by RECAP, samples of residential audits were analyzed as follows: over 22,000 electric audits and over 3,000 gas audits for PG&E; over 31,000 electric audits for SCE; over 2,000 electric audits and 1,500 gas audits for SDG&E, and over 5,500 gas audits for SoCalGas. The audits were developed by the RECAP audit tool for the SCE.com web site, as well as for all the Mail-in audits for the four IOUs. Mean and median energy usage intensities (EUIs) were generated for the residential end uses associated with energy saving measures recommended by the audit tools. These end uses/appliances included the following:

1. Central Air Conditioners
2. HVAC Fans
3. Space Heaters
4. Auxiliary Heaters
5. Spot Heaters
6. Water Heaters
7. Refrigerators
8. Freezers
9. Cooking Appliances
10. Laundry Appliances
11. Dishwashers
12. Lighting
13. Pool Pumps
14. Well Pumps
15. Water beds
16. TVs
17. Humidifiers
18. Dehumidifiers
19. Stereos
20. Other miscellaneous appliances such as spas, microwaves, shop tools, kilns, etc.

The RECAP consumption estimates are generally consistent across the four service territories. Similar to the Home Analyzer audit, the mean and median values of the EUIs for the RECAP audit were compared to PG&E's UEC estimates, as reported in their current Residential Energy Survey Report. No such comparisons were made for the other IOUs due to lack of data specific to their service territories.

4.9.2.2 UEC Comparison

The EUIs estimated by the audit were compared with PG&E UEC values. The values compared well: of the 11 end uses for which comparisons could be made, 6 were within 14 percent. The following appliances had significant differences:

1. Dishwashers - The audit estimates the motor only, as opposed to PG&E, which estimates usage for both the motor and water heating.

2. Gas water heaters– The audit estimates water heating for dishwashing and laundry together with all other hot water uses, as opposed to PG&E, which estimates water heating usage separate from dishwashing and laundry. Note that electric water heaters estimates were within 14 percent.

3. Well pumps and water beds – These have very low saturations so the differences are not a major concern.

4. Cooking – The difference may stem from the fact that PG&E estimates stove and oven usage only, while the audit may include other uses as well.

5. Refrigerators – The difference arises from the fact that PG&E's UEC is a per-unit usage, as opposed to the audit, which reports usage by all refrigerators in a home.

6. Central air conditioning – The difference may be due to the fact that audit EUIs could not be weighted based on location; the audit sample may be skewed toward homes located in the hot areas of California.

Unfortunately, there were a few end uses that could not be compared. PG&E did not report UECs for clothes washers, lights, humidifiers, dehumidifiers and stereos. However, the audit results for these three end uses look reasonable.

Overall, the UEC estimates compare well with the PG&E values and should provide a credible reference point from which savings estimates can be generated. The task of evaluating savings from recommendations remains to be conducted in a future evaluation year.

4.9.3 SDG&E Online Audit

SDG&E's Online home energy survey is powered by Enercom's Residential Energy Profile software. In order to protect proprietary information, Enercom's documentation of calculation methodology provides only high-level descriptions for the algorithms it uses for

estimating end use energy consumption.[10] Unfortunately, these algorithms are generally based on concepts that cannot be easily verified using general information available elsewhere (Consumer Guide to Energy Savings, manufacturer's ratings, DOE data, etc.). For example, when estimating heat gains or losses for a home, the algorithm uses "heat transfer multipliers". The information provided for these multipliers is that they "incorporate the component's thermal properties, the heating or cooling design temperature difference, and for cooling, the daily range." Since no numeric values are provided, the other details provided for the algorithm cannot be used to perform a sample calculation of heat gains or losses, and thus to estimate whether results are reasonable.

For some end uses the Enercom report did provide certain intermediate parameters that could be verified, and the values of those parameters were reasonable. These parameters were:

1. Lighting – assumed wattage for lamps
2. Dishwasher – kWh/load (the value does not include the energy to heat the water)
3. Range, oven and microwave – usage factors
4. Clothes washer/dryer – kWh/load usage factors (the value for the washer does not include the energy to heat the water)
5. Waterbed – kWh/month usage factors
6. Pool and spa – heater usage factors
7. Miscellaneous appliance – kW usage factors
8. Kitchen water usage factors
9. Laundry water usage factors
10. Toilet gallons per flush factors, and flushes/day factors
11. Default values for refrigerator kWh/month, by type/size and age
12. Default values for SEER (cooling) and HSPF (heating) by system age

Enercom's software tool does not store the end-use energy consumption and savings results calculated for each user, so an analysis similar to that performed for the Home Analyzer and RECAP tools is not possible at this time. We recommend SDG&E request that a database be incorporated into its web site, so that customer data are stored and a more thorough analysis of Enercom's software tool is possible in the future.

[10] Enercom Residential Energy Profile User's Manual and Documentation of Calculation Methodology. Not dated.

4.9.4 Estimated kWh and Therm Impacts

Table 4-41 shows the estimated total kWh and Therm savings at the program level, both by utility and statewide[11]. The average total savings for each utility was applied to the total number of participants from that utility. Similarly, the lower and upper mean confidence limits were applied to the total utility participant population. Thus, a point estimate of total program savings is provided, as well as a confidence interval around it.

Table 4-41
Estimated Program-Level Savings by Utility and Statewide

	PG&E	SCE Mail	SoCalGas	SDG&E Mail	SCE Online	Statewide Program
Total Program Participants	22,371	22,612	5,704	2,128	9,061	61,876
Total Program KWh Savings	13,450,116	7,650,996	-	479,183	2,723,555	24,606,851
Lower Bound of KWh CI	8,365,161	4,379,329	-	203,488	1,171,547	14,119,526
Upper Bound of KWh CI	18,535,071	10,922,663	-	754,878	4,275,563	34,488,176
Total Program Therm Savings	641,824	-	588,082	93,887	-	1,323,794
Lower Bound of Therm CI	305,955	-	443,862	68,070	-	817,887
Upper Bound of Therm CI	977,693	-	732,302	119,705	-	1,829,701

The key motivation in attempting to estimate energy savings at all is to remind policymakers that these programs, while not technically resource-acquisition programs, do produce energy savings, and these savings, because they are tied, in large part, to the installation of efficient measures, persist longer than two years, the current assumption for residential audits. Ridge (2002) recognized this phenomenon and recommended that the useful life of savings for residential audits be doubled.

Having said that, there are several reasons why these numbers might be biased. First, they are biased downward because the RECAP software does not estimate savings for many of the

[11] Note that no savings estimates were available for the PG&E, SDG&E, and SoCalGas Online Audits due to data inadequacies.

practices and several of the measures adopted by participants. Second, while residential customers can accurately report some behaviors, such as whether the equipment is still in place (Richardson and Skumatz, 2000), they are notoriously error prone when it comes to reporting on whether they have purchased energy efficient equipment, such as air conditioners and refrigerators (PG&E and CBEE, 1999). This means the numbers are very likely biased upward. Finally, we made no attempt in this study to capture any spillover, which will bias the estimates downward. Having said all this, the average annual savings of 438 kWh and 43.8 therms per household, while on the high end, are nevertheless in the plausible range.

4.10 Support of Resource Acquisition Programs

As pointed out by TecMarket Works (2004), one of the goals of information-only program evaluations is to:

> Provide information on the effects and effectiveness of the programs in motivating customers to either take efficiency actions on their own or to increase the possibility these customers will access or participate in other efficiency programs in order to determine which information and education programs are helping to meet California's current energy supply needs or the energy supply needs of the future (California Evaluation Framework, p. 226)

That is, is the HEES Program serving as a "feeder" program that funnels customers into resource acquisition programs such as the Residential Single- and Multi-Family Energy Efficiency Rebate Programs?

We attempted to determine whether those customers who implemented measures had to pay for those measures, what portion of the measure costs were covered by alternative sources of funding, and the extent to which those funds were provided by utility incentive programs. We first attempted to determine whether any of the adopted recommendations cost any money. Table 4-42 presents these results.

Table 4-42
Adoption of Recommendations That Cost Money

Utility	Audit Type	Yes	No	Don't Know	Respondents
PG&E	Mail-In	59%	37%	4%	76
SCE	Mail-In	70%	30%	0%	70
SoCalGas	Mail-In	39%	61%	0%	69
SDG&E	Mail-In	49%	48%	3%	65
SCE	Online	76%	24%	0%	71

From 39 percent to 76 percent of the respondents reported that the implementations cost money, with participants in the SCE Mail-In and Online Audits showing the highest percentages, followed by the PG&E Mail-In Audit. We assume that implementations that cost money are measures rather than practices.

Those who indicated that they used alternate sources of money were then asked the percent of the costs that were covered by those alternate sources of money. Table 4-43 presents the percent funded, utility, and audit type.

Table 4-43
Percent of Cost Covered
by Alternate Funding

Utility	Audit Type	0%	1%-10 %	11% - 20%	21% - 30%	31% - 40%	41% - 50%	> 50%	Don't Know	Respond-ents
PG&E	Mail-In	67%	4%	2%	0%	0%	2%	0%	24%	45
SCE	Mail-In	78%	6%	2%	2%	0%	2%	2%	8%	49
SoCalGas	Mail-In	70%	7%	0%	0%	0%	7%	4%	11%	27
SDG&E	Mail-In	69%	13%	0%	3%	0%	0%	3%	13%	32
SCE	Online	76%	6%	2%	0%	0%	2%	0%	15%	54

The vast majority of the measure implementations were not funded by alternate sources of money. While we agree that utilities have made reasonable efforts to inform all participants regarding the availability of rebates through various programs, these results suggest that utilities should explore additional strategies to inform participants.

Finally, those who indicated that they used alternate sources of money were asked about the sources of this money. Table 4-44 presents these results, by audit type.

Table 4-44
Source of Alternate Funding, by Audit Type

Utility	Audit Type	Bank Loan	Utility Rebate	Mfgr Rebate	Retailer Rebate	Other	Don't Know	Responses
PG&E	Mail-In	0%	75%	25%	0%	0%	0%	4
SCE	Mail-In	29%	57%	14%	0%	0%	0%	7
SoCalGas	Mail-In	17%	50%	0%	0%	33%	0%	6
SDG&E	Mail-In	17%	83%	0%	0%	0%	0%	6
SCE	Online	14%	57%	29%	0%	0%	0%	7

Of those few respondents who indicated that they used alternate sources of funds to help pay for the purchase of recommended measures, most mentioned the utility rebate followed by bank loans and manufacturer rebates. Retailer rebates were never mentioned. Assuming that one of the goals of the HEES Program is to funnel participants into resource acquisition programs, these data suggest that much more needs to be done to inform participants of these programs and the financial assistance they can provide.

This "feeder program" analysis was based on customer self-reports and is, therefore, to some extent less reliable than other approaches. We recommend that a more careful analysis of

how many of the PY 2002 and/or PY 2003 HEES participants actually participated in residential resource acquisition programs be conducted. For example, a more reliable approach would be to merge available accounts numbers of HEES participants with the account numbers of those participating in various residential resource acquisition programs. However, based on available evidence, the ability of the HEES Program to funnel participants into resource acquisition programs should be strengthened.

5 Conclusions and Recommendations

In this section we provide our conclusions and recommendations regarding a number of important issues:

- Evaluability assessment
- Marketing effectiveness
- Participant satisfaction
- Goal attainment
- Adoption ratios
- Energy savings
- Program improvement

5.1 Evaluability Assessment

Evaluability assessment is concerned with whether the available information associated with the implementation of a program will support the assessment of a program's performance. A related topic is the organization of the program-tracking databases and the quality of the database documentation. Both are discussed below.

5.1.1 Online Audit

The CPUC Energy Efficiency Policy Manual (EEPM) and the proposed California Evaluation Framework (CEF) (TecMarket Works, 2004) argue for a reasonably rigorous evaluation of information-only programs. The EEPM requires, among other things, that evaluations: 1) measure indicators of the effectiveness of programs, including the testing of the assumptions that underlie the program theory and approach, and 2) assess the overall levels of performance and success of programs. Thus, it seems necessary to interview participants to determine which recommendations they adopted, their levels of satisfaction, and any ideas they might have to improve the program. In addition, the CEF states that:

> The primary purposes of the information and education program evaluation efforts are to:
>
> a. Provide information on the effects and effectiveness of the programs in motivating customers to either take efficiency actions on their own or to increase the possibility these customers will access or participate in other efficiency programs in order to determine which information and education programs are helping to meet California's current energy supply needs or the energy supply needs of the future;
>
> b. Identify programs that need to be modified or improved to be more effective;
>
> c. Help identify best practices in the energy information and education program practice so that these practices can be documented, shared and replicated;
>
> d. Provide a system for documenting the accomplishments and the benefits received from spending Public Good Charge or energy procurement funds;

e. Help policy makers and resource planners determine which program services to fund to help acquire future energy resources;

f. Help resource supply planners identify a mix of energy resources that can be cost-effectively acquired to meet the energy needs of California's energy consumers. (p.226)

It is impossible to meet all of these evaluation objectives without contacting participants. As a result, the CEF recommends that " . . . if residential or commercial energy audits are provided, then contact information on the recipient of that service should be maintained and made available to the evaluation staff (p.229)."

Given the existing framework set forth in the EEPM and that proposed in the CEF (TecMarket Works, 2004), we recommend changes in the delivery of Online Audits and in the type of information that is maintained in the program-tracking databases. For example, the Online Audit should, at a minimum, collect enough information from participants so they can be interviewed at a later date by evaluators. Currently, SCE and SDG&E have an on-line audit or a version of the on-line audit that *requires* each customer to enter their e-mail address and, in some cases, provide their name and address[12]. However, in most cases, the participant can enter a fictitious e-mail address and name and still complete the energy survey and obtain results. Nevertheless, assuming that customers are entering their correct e-mail address, these customers can be surveyed via the Internet at a later date for evaluation purposes. These utilities should verify the percentage of e-mail address for Online Audit participants that are legitimate in order to assess the ability of evaluators to contact these customers at a later date. For PG&E, the provision of an e-mail address remains voluntary raising questions about the extent to which those who prove their e-mail address are representative of the population of Online participants. Thus, Internet surveys, for evaluation purposes, of those willing to provide their e-mail address might produce biased results.

Utilities should also retain information on the recommendations made to each participant along with the estimated savings for each recommendation. This information should be retained in the program-tracking database.

5.1.2 Databases and Documentation

PY 2002 was a year in which new software was implemented for the program-tracking database for the Mail-In Audit and the SCE Online Audit, both of which use the RECAP software and are maintained by Kema-Xenergy. As a result, we experienced serious delays in obtaining the necessary data and the documentation required to assemble the necessary files for sampling, and data collection was incomplete. It might be that during PY 2003, many of these database problems were resolved. To verify that these problems were resolved, we recommend that this database be reviewed to determine its current ability to support an evaluation.

[12] Many of the utilities are struggling with how to reduce barriers to participation in their Online Audits without compromising efforts to evaluate program effectiveness.

The documentation for Online Audit databases for SDG&E and PG&E, were poorly organized, incomplete and contained little of the necessary information required for an evaluation. Again, it might be that during PY 2003, many of the database problems were resolved. To verify that they were resolved, we recommend that these databases also be reviewed to determine their current ability to support an evaluation.

5.2 Marketing Effectiveness

Mail-In Audit acceptance or "take" rates for the four IOUs ranged from 8.5 percent to 11.5 percent. Participation in both the Mail-In Audits for the four IOUs and the Online Audits for the three IOUs covered most of their respective service territories. Efforts to reach the HTR populations based on ZIP code information, while reasonably successful, could be improved using 2000 Census data at a more refined level of detail such as census tract or block. Finally, while not ignoring the other HTR criteria, we recommend focusing more on participants with moderate incomes since they appear more likely to adopt recommended measures and practices.

5.3 Participant Satisfaction

Participants across all audit types are very satisfied with various aspects of the Mail-In and Online Audits, such as the amount of time required to complete the survey and relevance of the recommendations. The satisfaction of the non-HTR participants does not differ from the HTR participants.

5.4 Participant Attitudes and Awareness

Participant attitudes regarding energy conservation/efficiency are uniformly high. While the majority of participants were aware of the benefits of the measures and practices recommended in the audit and ENERGY STAR®, relatively few were aware of utility-sponsored conservation programs and even fewer took advantage of the financial assistance offered by these programs.

5.5 Goal Attainment

All four utilities met the requirement to mail at least 50 percent of their direct mail solicitations to HTR customers. In addition, all four utilities met their Mail-In Audit goals[13]. However, only SDG&E exceeded its target for Online Audit completions. This reveals, more than anything else, the unique challenges of reaching customers via the Internet. Finally, all four utilities reported in their fourth quarter reports that 50 percent of their Mail-In survey targets were sent to HTR customers.

5.6 Adoption Ratios

The overall adoption ratios for the Mail-In Audit and the SCE Online Audit are reasonably high, ranging from 40 percent to 54 percent. The overall adoption ratio is 47 percent.

[13] Recall that SDG&E and SoCalGas defined their Mail-In Audit goals in terms of audit surveys mailed and not audit surveys completed. If one defines their goals in terms of audit surveys completed (as did PG&E and SCE), then only SoCalGas met its goal.

Adoption ratios for the HTR population did not, in general, differ significantly from the non-HTR participants. However, when examining the moderate income HTR, the non-HTR participants tend to adopt measures while the HTR participants tend to adopt practices.

5.7 Energy Savings

To the extent that we were able to examine engineering algorithms and their inputs that support the estimates of savings for recommended measures and practices, we concluded that, for the most part, they appear to be reasonable. Those that appear to be unreasonable should be reviewed in the next evaluation of the HEES Program. The estimated energy savings for the statewide Mail-In Audit are 21,580,295 kWh and 1,323,793 therms. For the SCE Online Audit, the estimated kWh savings are 2,723,555. While these estimates are likely biased, both upward and downward, the average annual savings of 438 kWh and 43.8 therms per household, while on the high end, are nevertheless in the plausible range. Moreover, that half of the adopted recommendations are measures, suggest that the HEES Program clearly produces energy savings that last much longer than two years, the current residential audit assumption regarding the duration of savings. This assumption should be modified to better reflect the lifecycle energy savings for residential audits.

5.8 Support of Resource Acquisition Programs

We attempted to determine whether the HEES Program serves as a "feeder" by funneling customers into resource acquisition programs such as the Residential Single- and Multi-Family Energy Efficiency Rebate Programs. From 39 percent to 76 percent of the respondents reported that the implementations cost money, with participants in the SCE Mail-In and Online Audits showing the highest percentages, followed by the PG&E Mail-In Audit. However, the vast majority of the measure implementations were *not* funded by alternate sources of money. While we agree that utilities have made reasonable efforts to inform all participants regarding the availability of rebates through various programs, these results suggest that utilities should explore additional strategies to inform participants.

Finally, those few who indicated that they used alternate sources of money were asked about the sources of this money. Of those few respondents who indicated that they used alternate sources of funds to help pay for the purchase of recommended measures, most mentioned the utility rebate followed by bank loans and manufacturer rebates. Retailer rebates were never mentioned.