Final Report

Measure Retention Study – 1994 & 1995 Residential Weatherization Programs (RWRI)

Submitted to
San Diego Gas & Electric Company
(Study ID #957)
and
Pacific Gas & Electric Company
(Study ID #332R1)

March 1, 1999

Final Report

Measure Retention Study – 1994 & 1995 Residential Weatherization Programs (RWRI)

Submitted to
San Diego Gas & Electric Company (Study ID #957)
and
Pacific Gas & Electric Company (Study ID #332R1)

March 1, 1999

by

Megdal & Associates
Dr. Lori Megdal
198 High Street
Acton, MA 01720-4218
Telephone: 978/461-3978
Fax: 978/461-3979
E-mail: megdal@tiac.net

and

ASW Engineering Management Consultants, Inc.

Table of Contents

Executive Summary

Background and Study Method

The California Demand Side Management Advisory Committee (CADMAC) measurement and evaluation (M&E) Protocols require Retention Studies at specific retention years depending on the program. The purpose of the Retention Study is to collect data to determine the retention and effective useful life (EUL) for the primary measures in the program. This involves measuring the proportion of measures still in place, operational, and effective. The retention information along with considerations of time since program participation provide the basis for development of the *ex post* EUL. The *ex post* EUL is then statistically compared with *the ex ante* EUL.

This study is the Measure Retention Study for the 1994/1995 Residential Weatherization Retrofit Incentives Programs (RWRI) operated by San Diego Gas & Electric Company (SDG&E) and Pacific Gas & Electric Company (PG&E). It is a joint study given the waiver request approved by CADMAC on August 19, 1998 for Study ID Numbers 332R1 (PG&E) and 957 (SDG&E). This report includes the tables required by the M&E Protocols.

The measures included in this study were the primary measures for the RWRI programs. These are:

- Attic and ceiling insulation (SDG&E and PG&E),
- Infiltration (SDG&E),
- Wall insulation (PG&E), and
- Floor insulation (PG&E).

The sampling plan was designed to ensure representation across study measures and for each utility. Direct observation of measure retention and surveys of residents were obtained through 250 site visits conducted by trained auditors.

The primary retention measurement is the proportion of measures that are in place and operational. This is derived from survey information by analyzing frequencies and means of the site visit data by measure. The Effective Useful Life (EUL) analysis came from calculating the expected median from an exponential model given the average length of time since installation and the average retention rate at that time.

Findings

The sample sizes and retention estimates are provided in Table ES.1.

Table ES.1[1] Retention Findings

	Utility(ies)	N	Retention Rate
Wall insulation	PG&E	68	100%
Floor insulation	PG&E	34	100%
Attic and ceiling insulation	PG&E and SDG&E	194	99.2%
Infiltration	SDG&E	89	86.2%

* The sample size counts are the number of sites (homes) treated.

The measure retention estimates range from a high of 100 percent to a low of 86 percent. These weatherization measures show quite high retention, as would be expected given that many are not readily accessible to the occupants. The lowest retention rate, 86 percent, is found for infiltration measures which include some smaller items more easily disrupted by the occupant, such as electrical outlet insulation and window caulking.

The *ex post* EUL estimates from the exponential model, retention rates, and *ex ante* EULs are presented in Table ES.2.

Table ES.2[2] EUL Estimates

	***Ex Ante* EUL**	**Retention Rate**	***Ex Post* EUL**
Attic and ceiling insulation	25 – PG&E 20 – SDG&E	99.2%	319 years
Wall insulation	20	100%	Assumed to be same as attic insulation
Floor insulation	20	100%	Assumed to be same as attic insulation
Infiltration	10	86.2%	14 years

The confidence interval for the *ex post* EUL estimate for attic insulation is 185 years to 1,091 years. This range does not include the *ex ante* EUL estimates of 20 years for SDG&E and 25 years for PG&E. Generally, the *ex post* EUL estimates would be adopted in cases such as this where the *ex ante* estimates are not within the 80% confidence interval. We are, however, making a more conservative recommendation than that of accepting the *ex post* EUL of 319 years. This retention study occurred early in the expected EUL of attic insulation and homes

[1] This table is the same as Table 3.4 and is further described in Section 3.
[2] This table is the same as Table 3.7 and is further described in Section 3.

themselves are not generally expected to stand 319 years. In this context, we recommend adopting the *ex ante* EUL estimates.

Similarly, the *ex ante* EUL estimate for infiltration falls outside the 80% confidence interval of the *ex post* EUL estimate. The 80% confidence interval for the *ex post* infiltration EUL estimate is 12 to 18 years. The *ex ante* EUL estimate is 10 years. Again, we recommend a conservative approach by adopting the *ex ante* EUL estimate.

In conclusion, the *ex post* EULs validate that the expected EUL is at least as long as the ex ante EUL. Given how early this measure retention study is compared to the expected life, we recommend the conservative approach of adopting the *ex ante* EUL estimates as the best available EULs for these program measures.

1.0 Introduction

1.1 Project Background

Standardized protocols for demand-side management (DSM) evaluation were developed in California through the cooperative efforts of utility DSM evaluation experts, interested parties, regulatory staff, and outside consultants working through the California Demand Side Management Advisory Committee (CADMAC). These measurement and evaluation (M&E) protocols are the standardized expectations for DSM evaluation which serve as the basis for the measurement of *ex post* energy savings caused by energy efficiency programs, whose measurement determines the shareholder incentives to be received by the utility due to the utility's performance in obtaining these savings.

The M&E Protocols' require Retention Studies at a specified number of years after the program year depending on the program. The purpose of the Retention Study is to collect data to determine the empirical effective useful life (EUL) for the measures representing the top 50% of resource benefits[3]. This involves measuring the proportion of measures still in place, operational, and effective. The retention information along with considerations of time since program participation provide the basis for development of the *ex post* EUL. The *ex post* EUL is then statistically compared with the *ex ante* EUL at an 80% confidence level[4].

This study is the Measure Retention Study for the 1994/1995 Residential Weatherization Retrofit Incentives Programs (RWRI) operated by San Diego Gas & Electric Company (SDG&E) and Pacific Gas & Electric Company (PG&E). It meets the requirements of the fourth year retention studies specified in Table 8A and Table 9A of the M&E Protocols. The utilities believed that the type of measures seen in these residential programs would make them likely to have high retention rates. Given this and the increase in cost-effectiveness, the utilities proposed a Waiver Request to conduct this joint retention study in place of individual studies. This Waiver Request for a joint study was approved by CADMAC on August 19, 1998 for Study ID Numbers

[3] *Prepared Testimony of Kevin C. McKinley, Chair, California DSM Measurement Advisory Committee (CADMAC) in the 1998 Annual Earnings Assessment Proceeding (AEAP) Before the Public Utilities Commission of the State of California*, September 8, 1998, pp. 11.

[4] Ibid, pp. 16.

332R1 (PG&E) and 957 (SDG&E). This joint study was designed in accordance to this Waiver Request and the M&E Protocols. This report also presents Tables 6 and 7 as required by the M&E Protocols as modified according to CADMAC testimony on September 8, 1998.[5]

The programs provided subsidized weatherization services to residential customers. The Study examined program measures that allowed for meeting the "top 50% of resource benefits" requirement of the M&E Protocols on Table 9A. The measures examined account for 69% for PG&E's resource benefits and 62% of SDG&E's total resource benefits of the program. The measures included in this study were:

- Attic and ceiling insulation (SDG&E and PG&E),
- Infiltration (SDG&E),
- Wall insulation (PG&E), and
- Floor insulation (PG&E).

The specific measurement information for these primary measures is provided in Table 1.1.

Table 1.1 Information on RWRI Primary Measures[6]

Utility	Program Year	Total Resource Benefits	Measures	% of Resource Benefits	No. of Participant Homes
PG&E	1994 & 1995	$7,509,000			
			Attic insulation (electric & gas)	37%	5,121
			Wall insulation (electric & gas)	11%	885
			Floor insulation (electric & gas)	19%	505
SDG&E	1995	$569,756			
			Infiltration-cooling (electric)	27%	1,534
			Attic-cool insulation (electric)	20%	490
			Infiltration-heating (gas)	15%	1,643

[5] *Prepared Testimony of Kevin C. McKinley, Chair, California DSM Measurement Advisory Committee (CADMAC) in the 1998 Annual Earnings Assessment Proceeding (AEAP) Before the Public Utilities Commission of the State of California,* September 8, 1998.

[6] Taken from *Pacific Gas & Electric and San Diego Gas & Electric Waiver Request for 1994 and 1995 Residential Weatherization Retrofit Incentives Programs (Study ID Nos. 332R1 (PG&E) and 957 (SDG&E)).* Approved by CADMAC on August 19, 1998. Provided as Appendix F.

The utilities and regulatory staff selected the basic methodology for this study to consist of 250 site visits. A sampling plan was designed to ensure representation across measures and the two utilities. At the same time, all sampled participants were surveyed for all measures installed (regardless of the measure for which they were pulled into the sample). This allowed the sample sizes for the measures to be maximized.

The Study's approach and protocols were designed to meet the challenges presented in obtaining retention information years after participation, while ensuring a high quality of customer service and data collection. This was accomplished through a carefully designed instrument and the use of well-trained recruiters and auditors with many years of experience in providing utility customer services. A complete Surveyor's Guidebook and the recent experience performing similar work for the Direct Assistance Program (DAP) Retention Study helped support meeting these objectives.

Quality control procedures were developed and used to assure the accuracy of the data collected and analyzed. Protocols were also established and used to ensure proper customer service and efficient working relationships with the utilities sponsoring the study.

The site survey instrument and the analysis were designed to be straight forward. This allows a greater ease in interpreting the results and for others in reviewing the study and its findings. The primary retention measurement is the proportion of measures that are in place and operational. This is derived from survey information by analyzing frequencies and means of the site visit data by measure. The retention information along with considerations of time since program participation provide the basis for development of the *ex post* EUL. The *ex post* EUL is then statistically compared with *the ex ante* EUL.

1.2 Program Overview

San Diego Gas & Electric's RWRI program was part of their DSM Replacement Bid Pilot as a result of meeting the California Public Utility Commission's goal for DSM bidding. SDG&E contracted with SESCO to operate the RWRI program whereby SESCO offered free conservation improvements to selected homes. The program operated as approved by the CPUC on February 8, 1995 in Application 94-08-038. SESCO targeted customers based upon customer consumption history. The conservation measures installed included: attic and ceiling insulation, weatherstripping, caulking, outlet insulation, sealing by-passes, low-flow showerheads, water

heater and pipe wraps, and compact fluorescent lights. Conservation measures were installed in 1,994 homes through this program.

Pacific Gas & Electric's RWRI program was an Insulation Rebate Program conducted in 1994. PG&E did not implement programs in this category in 1995. Accomplishments, however, occurred in 1995 as a result of carry-over of Insulation Rebates from 1994. The rebate program assisted residential weatherization efforts by helping to offset the costs for customers to add insulation in their attics, walls and/or floors. This insulation would in turn reduce the loss of heating and cooling resulting in energy savings for the customers and the utility. The rebate was based on the type of heat and central cooling present in the customer's home.

1.3 Report Overview

Section 1 has provided an overview of the project, being completed with this overview of the report itself. Section 2 presents the methodology of the study. The last section, Section 3, presents the study findings including information on the sample, measure retention estimates, and the effective useful life examination (EUL). The last subsection of Section 3 also presents a summary of the documentation protocols as required in Table 7, and the reporting protocols as required in Table 6 of the revised M&E Protocols. The body of the report is followed by appendices that contain material from the Surveyor's Guidebook; the site visit instrument; the site survey responses; the frequencies, means and statistics used for the retention and EUL analyses; and the datasets and documentation for the study (in accordance with the M&E Protocols).

2.0 Methodology

2.1 Measurement Issues

Retention Measurement

One of the primary objectives of this study was to answer the questions: "Is the measure still in place?; Is it operational?; and Is it still effective?". This is in accordance with the M&E Protocols' definition of a Measure Retention Study:

> "An assessment of (a) length of time the measure(s) installed during the program year are maintained in operating condition; and (b) the extent to which there has been a significant reduction in the effectiveness of the measure(s)."[7]

The methodology selected was based upon these needs, understanding the differences between a measure retention study and a persistence study, and developing a workable methodology for conducting 250 site visits to gather the data to answer this question.

This study was designed only as a measure retention study and not a persistence study. Only a few practitioners with significant experience in conducting persistence studies understand the differences between these two types of studies. One of the primary differences after the studies are conducted lies in their acceptable uses. Given that this study is a measure retention study, the results should only be used as a measure retention study (unless further adjustments and examinations are made).

An example of an improper use of a measure retention study would be to use its results along with prior impact evaluation. This improper use of the retention results could yield a double-counting of losses. As an example, suppose a program database indicated that 100 low flow showerheads should have been installed. Then an impact evaluation is conducted one year post-participation. This impact evaluation finds 97 showerheads installed (or implicitly accounts for this loss in a lower realization rate in a billing analysis such as a 97% realization rate). Then suppose two years later a retention study is done and finds 90 showerheads in place and operational. If the study were conducted as a measure retention study only, using as its baseline the program database, the retention study would find a loss of 10 showerheads (100-90) or a 90%

[7] Measure Retention Study definition from page A-7 of the March 1998 edition of the California Measurement & Evaluation (M&E) Protocols.

retention. This could be an accurate measure retention estimate. However, if the retention study results were applied to the impact evaluation's savings to estimate savings still being achieved, there would be a double-count of the 3% loss. The persistence retention rate would need to be re-estimated as 93% (90/97) in order to be applied to the impact savings estimate. Of the 10 showerheads not in place at the time of the retention study, three are in the program database but were never actually installed and seven were the retention loss in the form of persistence from the impact evaluation.

As this study is a measure retention study, and not a persistence study, it did not gather data on usage or analyze data measuring potential long-term participant spillover (market transformation for participants), as doing so could cause confusion to readers of the report.

Effective Useful Life Measurement

The second primary objective of this study is to assess *ex post* effective useful life (EUL). This assessment primarily lies upon analysis of the retention information. There were, however, a few additions to the survey instrument given the goal of assessing EUL. The questions for the insulation measures also included follow-up questions for cases of removal as to when the insulation was removed and why it was removed.

2.2 Survey Instrument and Protocols

The programs, their measures, and a discussion of what was needed in the site survey instrument were discussed as part of the kick-off/working teleconference. This provided the initial basis for developing the first draft of the survey instrument.

The first page of the instrument includes information from the program database and contact information verified as part of the recruiting process. This is followed by the data collection forms. These were kept simple and straight forward in order to ensure the collection of meaningful information in a consistent manner across auditors. Each measure of interest has its own small section. The auditors only observed/asked those sections that were applicable to the site as indicated by the program database information.

The draft instrument was reviewed by each Utility Study Manager and an iterative revision process was conducted to develop the instrument to be used in the pre-test. One of the last steps was to divide the instrument into separate instruments for each utility service territory, providing consistent instruments so a consolidated analysis database would be easily derived while ensuring that

instruments could be fielded in a way to minimize error in the audit process and the data entry process.

This study also built upon the experience gained in conducting the recent Statewide Retention Study of Direct Assistance Program (DAP) conducted by the same team. This earlier retention study also examined retention of residential weatherization measures. The cost-effectiveness of this study was enhanced by using the recruiting and data collection protocols and Surveyor's Guidebook that was developed in the DAP study. The Surveyor's Guidebook was developed to enable a consistently high quality of effort in the recruiting and data collection phases of the project. This Guidebook was used to develop mutually agreed upon protocols, as a training tool for the auditors, and as a procedure manual for the fielding of the project. The material from the Surveyor's Guidebook is included in this report as Appendix A.

The final draft survey instrument was then pre-tested according to the recruiting and data collection protocols. A few minor revisions were made to the wording of survey questions given the pre-test results. This created the final instrument, as approved by the Utility Study Managers, designed to meet the objectives of this study and obtaining the most accurate information for this purpose.

The final site visit instruments are included as Appendix B.

The sampling, as discussed in Section 2.3, was applied uniformly and yet separately by utility. This minimized the database changing and cleaning issues, as the creation of one program population database was avoided.

A project tracking number was assigned to each customer in the sample prior to the sampling dataset moving to the Recruiting, Scheduling, and Data Collection Database. This tracking number was used for data collection efforts, and for datasets without customer contact information where this number could be used to match back to the customer identification information. (The final datasets provided with this project are without customer identification. This maintains customer confidentiality while providing all the data used in this project's analyses and provided in accordance to the M&E Protocols.)

Protocols for data collection and entry are provided in the Surveyor's Guidebook in order to assure the highest quality data collection effort.

The sequence of data processing for sampling and for analysis was conducted step-by-step in order to provide a systematic approach to save and document each step. In this way, quality control was implemented and, the preparation of the evaluation databases and documentation, as required by the Protocols, was performed alongside the work effort.

2.3 Sampling

Random sampling is the easiest way to insure generalizability of the results to the overall population. It is also the easiest to use and to explain. Given this, random sampling is an important part of the sampling plan.

There is some possible improvement (i.e., removal of a potential selection bias) in surveying dwellings randomly whether the current occupant was the participant or whether a new occupant had moved into the dwelling. Current customer name and telephone numbers were obtained where this could be accomplished in a timely manner. This was at least partially possible at PG&E and, therefore, these steps were added to the sampling procedures for PG&E's samples.

The sampling goals were derived by first dividing the 250 sites between the two utilities according to their respective proportions of the sum of the participant counts for these measures. This allocated 160 sites (64 percent) to be conducted in PG&E's service territory and 90 sites (36 percent) to be conducted in SDG&E's service territory. The total number of sites per utility was then allocated relatively evenly between the primary measures in that utility's RWRI program. This resulted in the sampling goals shown in Table 2.1.

Table 2.1 Measure Counts and Sampling Plan

Utility	Measures	Participant Count	Sampling Goal
PG&E			160
	Attic insulation	5,121	60
	Wall insulation	885	50
	Floor insulation	505	50
SDG&E			90
	Infiltration-cooling	1,534	30
	Attic-cool insulation	490	30
	Infiltration-heating	1,643	30

Random samples were conducted for each of the above groups, obtaining twelve times the sampling goal for each group. The customer records selected from this sampling were completed with annotation for all measures they received. (Given the large number of multiple measures per dwelling, the final measure counts are much higher than the minimum sampling goals.) These sample lists were then combined and randomized by utility to provide the recruiting database.

2.4 Analysis for Retention Estimates

Many of the retention equipment studies examine whether or not the piece of equipment is still in place and operational. Contrary to this, all the primary measures of the RWRI programs could be totally there, partially there or not there at all. It is not an all or nothing possibility.

Insulation and infiltration measures could have part of the installed measure removed. The instrument accounted for this by measuring retention with a multi-category response, for the answer to the question of what proportion of the measure is still in place. The effectiveness for these measures is observed as being on average fully, mostly, half, less than half, or having none of its effectiveness.

The survey contained retention measurement questions and gathered other information to support the retention analysis. The retention measurement questions by measure are presented in Table 2.2.

Table 2.2 Survey Retention Questions

Measure	Survey Question
Attic insulation	Q2 What proportion of the attic insulation is still in place (of that you can tell was originally there)?
Wall insulation	Q7 *Given the above customer estimates and auditor observations:* What proportion of the (wall) insulation installed through the program is still in place?
Floor insulation	Q12 *Given the above customer estimates and auditor observations:* What proportion of the (floor) insulation installed through the program is still in place?
Infiltration	What proportion of the _____ is still in place (of that you can tell was originally there?) Q15 window caulking Q16 weatherstripping on exterior doors Q17 electrical outlet insulation (switches and receptacles) Q18 sealing on bypass (sealing on plumbing accesses & special openings)

These categories measured retention as: 100%, 75%, 50%, 25%, and 0% retention (in place, operational, and effective) for the survey observations: fully, mostly, half, less than half, and none, respectively. This measurements provides a retention estimate per site (household) for attic insulation, wall insulation, and floor insulation. The site estimates for the four infiltration measurements

(survey questions 15 – 18) were averaged to obtain a site infiltration retention estimate. The overall measure retention estimate is then the mean of the site retention estimates. The overall retention estimate for attic insulation is the weighted mean of the site estimates, taking into account the different weights for PG&E customers versus SDG&E customers in order for the overall retention estimate to properly represent all participating sites for these two utilities.

2.5 Effective Useful Life Analysis

The purpose of the EUL analysis is to create an *ex post* EUL estimate that is then compared to the *ex ante* EUL estimate. The *ex ante* EUL for study measures ranges from 10 years to 25 years. The *ex ante* EULs are presented in Table 2.3.

Table 2.3 *Ex Ante* EULs

Utility	Measures	*Ex Ante* EUL
PG&E		
	Attic insulation	25 years
	Wall insulation	25 years
	Floor insulation	25 years
SDG&E		
	Attic insulation	20 years
	Infiltration	10 years

The measure retention percentage and the answers to when the insulation measures were removed are the basis for development of the *ex post* estimate of Effective Useful Life (EUL). We recognize that the best measurement of EUL would utilize retention measurement that occurred long enough after installation to be likely to capture the median life (i.e., achieving a retention rate of 50 percent or less). This study, however, does not have that luxury. The M&E Protocols calls for a 4th year retention study for these programs, with this study to include development of an *ex post* EUL and a comparison of the *ex post* EUL to the *ex ante* EUL by measure.

Many energy efficiency retention studies examine energy efficiency equipment as being either there or not. This dichotomous scale allows the possibility of using classical survival analysis techniques. These techniques originated in the medical field where the concern was for mortality or whether someone contracted the studied disease. These outcomes are dichotomous, they either occur or not and can be measured as zero or one events.

Insulation and infiltration can have partial retention. They are not necessarily either there or not, as is the case for many efficiency equipment measures. These partial retention possibilities were taken into account in the survey instrument by using five possible responses rather than just two. This range of possible retention estimates means that techniques that rely on 0-1 measurement are not appropriate. This makes classical survival analysis an inappropriate technique.

The M&E Protocol definition of EUL, as modified according to CADMAC testimony on September 8, 1998, is:

> "An estimate of the median number of years that the measures installed under the program are still in place and operable."[8]

A common model form in classical survival analysis is an exponential failure model. Though we do not have a 0-1 measurement that allows for classic survival analysis, we can still use an exponential model. One of the primary advantages of using an exponential model is that it provides a simple assessment of the median and, therefore, makes it straight forward to predict the effective useful life (EUL). With these advantages, an exponential model was selected to predict the EULs for the measures in this study.

In a recent persistence study for Southern California Edison (for their Non-Residential New Construction program), RLW Analytics had examined this issue and put forth the necessary basic formulas for using the exponential model in this way. The following presentation is taken from their work.

The exponential survival function is:

$$S(t) = e^{-\lambda t}$$

The mean survival time is then $1/\lambda$.

Defining the EUL as the median creates the following equation:

$$S(t) = e^{-\lambda t} = 0.5$$

Solving for t = EUL, obtains:

$$EUL = -\ln(0.5)/\lambda$$

Observing *S* in a sample with average measure age t can then be used to solve the survival function for $\lambda = \ln(S)/t$. Substituting into the previous equation provides us with the formula for the predicted EUL as follows:

$$\text{Predicted EUL} = [t \ln(0.5)] / \ln(S)$$ where S=survival proportion

[8] *Prepared Testimony of Kevin C. McKinley, Chair, California DSM Measurement Advisory Committee (CADMAC) in the 1998 Annual Earnings Assessment Proceeding (AEAP) Before the Public Utilities Commission of the State of California,* September 8, 1998, p. 20.

The predicted EUL (*ex post* EUL) is compared to the *ex ante* EUL to derive the EUL realization rates. This is expressed as:

EUL Realization Rate = *Ex Post* EUL/*Ex Ante* EUL

Confidence intervals will then be estimated using the predicted EUL equation and the confidence interval upper and lower limits for *S* and *t*.

3.0 Findings and Results

3.1 Sample Disposition

The samples were drawn, checked, and provided for recruitment as planned. The recruiting occurred according to the protocols, resulting in the necessary number of sites being recruited. Though procedures were used to obtain names and telephone numbers of current occupants for over 60 percent of the sample, there were still a large percentage of wrong or disconnected numbers. The site visit goals were completed, but a greater number of calls were required to do so than originally anticipated.

Each utility was provided with their own call disposition report when the site visits were completed in their territory. The overall call disposition is provided in Table 3.1.

Table 3.1 Call Disposition

	Pacific Gas & Electric	San Diego Gas & Electric
Scheduled Survey	160	90
Scheduled Call Back	134	66
Left Message	7	30
Busy	12	7
Answering Machine	116	26
No answer	65	79
Call back later	1	2
Over Quota	0	0
Not Qualified	0	0
Wrong Number	78	103
Initial Refusal	18	2
Mid-Terminate	8	0
Business fax	0	1
Disconnected Number	52	90
Language Barrier	0	0
Moved Out	0	0
Total Number of Calls	651	496
% Scheduled	25%	18%
% Wrong #/Disconn.	20%	39%

3.2 Characteristics of the Sample and Weighting

The required 250 site visits were completed with 160 sites in PG&E's territory and 90 site visits in SDG&E's service territory, as planned. As discussed in Section 2, the sampling plan was designed to ensure representation across utilities and measures. Yet, all measures were examined that were installed by the program at each site, when a site was selected in the sample and recruited. This provides sample sizes for measures much greater than the minimum used in the sampling plan.

This procedure worked successfully, obtaining measure sample sizes from 34 to 194 for each measure category in the sampling plan. The obtained sample sizes are provided in Table 3.2.

Table 3.2 Sample Sizes

Measure	Sample Size
Attic insulation	194
Wall insulation	68
Floor insulation	34
Infiltration	89

One of the four measures (attic insulation, wall insulation, floor insulation, and infiltration) examined in this study was common to both utilities, attic insulation. The retention estimate for attic insulation was estimated across both utilities. Given the stratified random sampling described above, the overall attic insulation estimate was obtained using a weighting to obtain an estimate that properly represents the measurement for attic insulation in both programs.

There are a few different ways to derive weighting schemes. The differences between the methods is generally one of scale. The primary purpose of the weighting is to assign different weights relative to the weights of the other strata so that the overall analysis properly represents the overall population. This means that the importance is in the weights relative to one another rather than the absolute number of any given weight. (Since it is the relative weights that are important, many weighting schemes can produce the same results because they have the same relative weights.)

The weights used in this study were derived by comparing the sample proportions for attic insulation by utility to the proportion among actual participants. This comparison and the derived weights are presented in Table 3.3.

Table 3.3 Attic Insulation Counts and Derived Survey Weights

Utility	Sample Counts	Sample %	Actual Counts	Actual %	Weights (Actual % / Sample %)
PG&E	131	67.5%	5,121	91.3%	1.35
SDG&E	63	32.5%	490	8.7%	0.27

3.3 Retention Findings

The complete site visit dataset (including site visit results and program database indicators for measures) was cleaned into an Excel© spreadsheet. This was read into SAS© dataset for further analysis. SAS© was used to obtain measure counts, frequencies, convert responses to retention scale (1=All, 0.75=Most, etc. as described in Section 2), computing retention means by measure, and obtaining statistics for other analyses. (Appendix C presents measure counts and the basic survey results. Additional analyses and statistics examined in the retention analyses are provided in Appendix D.)

The means (and weighted mean for attic insulation) of the site retention estimates are the overall measure retention estimates.

The measure retention estimates range from a high of 100 percent to a low of 86 percent. These weatherization measures show high retention, as would be expected given that many are not readily accessible to the occupants. The lowest retention rate, 86 percent, is found for infiltration measures which include some smaller items more easily disrupted by the occupant, such as electrical outlet insulation and window caulking.

Table 3.4 Retention Findings

	Utility(ies)	N	Retention Rate
Wall insulation	PG&E	68	100%
Floor insulation	PG&E	34	100%
Attic and ceiling insulation	PG&E and SDG&E	194	99.2%
Infiltration	SDG&E	89	86.2%

* The sample size counts are the number of sites (homes) treated.

The PG&E measures were installed in 1994 and 1995. This offered the potential to examine retention rate differences between the two durations (three

and four year). Wall insulation and floor insulation had 100% retention making this examination fruitless for these measures.

Attic insulation, however, was examined for each of these program years. The retention rates were 99.8% for program year 1994 (4 years since installation) and 97.4% (3 years since installation) for program year 1995. As the retention of a measure can not go up over time, there is enough variation when examining across program years or cohort effects such that differences between program years can not be interpreted as representing retention trends over time.

Attic insulation in a long-life measure and the difference between three and four years is not enough time since installation to ensure that the natural randomness is smaller than the expected long-term trend. This is not an unusual finding for attic insulation measures. In fact, the studies generally find this kind of random variation in the early program years. Table 3.5 presents the retention findings by program year for residential insulation measures found by three different studies.

Table 3.5 Residential Insulation Retention Rates by Program Year Found in 3 Studies

Study	t = 2 years (program year	t = 3 years (program year)	t = 4 years (program year)	t = 5 years (program year)
RWRI Study		97.4% (1995)	99.8% (1994)	
DAP Study (low income programs in CA)	92.6% (1996)	97.7% (1995)	100% (1994)	
Boston Edison Company's 1997 DSM Persistence Study (residential programs)	94% (1995)	100% (1994)	93% (1993)	96% (1992)

Given these findings, the most reliable retention estimate is the combined retention estimate as reported in Table 3.4 above.

3.4 Effective Useful Life (EUL) Analyses

With 100 percent retention in wall insulation and floor insulation, no additional analysis was possible. The EUL can not be calculated from the exponential model with no failures. However, full retention after three to four years provides evidence that the *ex ante* estimates are probably not too short. The *ex*

post EUL for wall insulation and floor insulation is assumed to be the same as the *ex post* EUL for attic insulation, which can be estimated from the exponential model.

The exponential model was used to calculate the predicted EUL as described in Section 2.5. Recall the equation for the predicted ex post EUL is as follows:

Predicted EUL = [t ln(0.5)]/ ln (S) where S=survival proportion

The input and predicted EUL results are provided in Table 3.6. A spreadsheet was used to calculate the predicted EUL. However, the formula is simple enough that with the input in Table 3.6 (average retention rate and average duration) the predicted EUL could be produced on a hand-held calculator.

Table 3.6 Input and Predicted EUL Results from Exponential Model

	Average Retention Rate	**Average Duration Observed**	***Ex Post* Predicted EUL**
Attic and ceiling insulation	99.2%	3.7 years	319 years
Wall insulation	100% Exponential model unsolvable.		Assumed to be same as attic insulation
Floor insulation	100% Exponential model unsolvable.		Assumed to be same as attic insulation
Infiltration	86.2%	3 years	14 years

The EUL realization rates are provided in Table 3.7.

Table 3.7 EUL Realization Rates

	Utility	**Ex Post EUL**	**Ex Ante EUL**	**Realization Rate**
Attic and ceiling insulation	PG&E	319	25	12.76
	SDG&E	319	20	15.95
Infiltration	SDG&E	14	10	1.40

This subsection presents the confidence intervals for this analysis. These are confidence intervals measuring sampling error, how adequate the sample is in estimating the results for the population from which the sample is drawn. In other words, if the exact same measurement tool is used, the confidence level provides us the probability of falling within the interval in repeated samples or, similarly, the probability that the results for the population as a whole would be

within the interval around the results found for the sample. This is the standard measurement and use of confidence intervals.

An estimate of the confidence intervals for the EUL estimates is derived in a three step process. These steps are:

1. Calculate the confidence intervals for the retention estimates (for the measures with EUL calculations – attic insulation and infiltration).
2. Calculate the confidence interval for duration for attic insulation. (There is no variation over a year possible with infiltration given there is only one program year.)
3. Estimate the low interval EUL confidence number by using the low interval level for retention with the low interval level for duration in the exponential model to obtain maximum low interval. Do the same with the high level to obtain the high interval EUL confidence number.

The confidence interval calculations in steps one and two are based upon well-accepted formulas that are used to estimate confidence intervals for sampling error. The retention estimates are means and are, therefore, point estimates. As such, the calculation of the confidence level is straight forward based on the formula for confidence intervals for point estimates. This formula is as follows:

$$\text{Mean} - t\,(sd/\sqrt{N}) < \text{Mean} < \text{Mean} + t\,(sd/\sqrt{N})$$

where:

t	=	score representing desired level of statistical significance
sd	=	standard deviation
N	=	sample size

Table 6 of the M&E Protocols requires the confidence interval be produced for the 80 percent level.[9]

Using the three step process described above, conservative estimates (wide span) of the EUL confidence intervals were made. The *ex post* EUL confidence interval estimates are presented in Table 3.8.

Table 3.8 *Ex Post* EUL Confidence Interval Estimates

	Confidence Interval* *Ex Post* **EUL to**	
Attic and ceiling insulation	185 years	1,091 years
Infiltration	12 years	18 years

* 80% Confidence interval α=20%.

[9] *Prepared Testimony of Kevin C. McKinley, Chair, California DSM Measurement Advisory Committee (CADMAC) in the 1998 Annual Earnings Assessment Proceeding (AEAP) Before the Public Utilities Commission of the State of California,* September 8, 1998, pp. 6.

The above estimate required an assumption of desired level of statistical significance, α. This is setting our Type I error, the risk of rejecting a true hypothesis. There is a trade-off between the degree we are willing to accept a Type I error (rejecting a true hypothesis) and that associated with a Type II error, the error of failing to reject an hypothesis when it is actually false. This α is the p-value required by Table 6 of the M&E Protocols.[10]

Using the standard deviation of the estimate to develop confidence intervals generally measures sampling error. In general, what is measured is if the exact same measurement tool is used, the confidence level provides us the probability of falling within the interval in repeated samples or, similarly, the probability that the results for the population as a whole would be within the interval around the results found for the sample. This is the standard measurement and use of confidence intervals.

A measurement of the confidence interval does not measure the overall accuracy of the estimate. This is because there are generally two types of possible errors. These are:

1. Sampling error
2. Measurement error

The confidence interval allows us to measure possible sampling error. There is no readily available and accepted measurement to assess measurement error. (Measurement error is the error from the tool or technique used for the measurement or that the hypothesized model is not the one and only true model for the process being examined.)

The site visit technique used was a visual inspection by experienced auditors. The survey instrument was set to minimize bias that could result from differences between auditors in assessing retention. This was accomplished by asking the auditors to round their estimates of retention into the categories on the instrument: All, Most, Half, Less than Half, and None. These categories also represent our professional assessment of the accuracy possible for a visual inspection, i.e., an approximation of the inherent measurement error. Other analyses indicate that the maximum likely variation in this measurement scheme could double the confidence intervals.

The 80% confidence intervals incorporating sampling error as required by the M&E Protocols are shown above in Table 3.8[11]. The confidence interval for

[10] Ibid.

[11] *Prepared Testimony of Kevin C. McKinley, Chair, California DSM Measurement Advisory Committee (CADMAC) in the 1998 Annual Earnings Assessment Proceeding (AEAP) Before the Public Utilities Commission of the State of California,* September 8, 1998, pp. 16.

the *ex post* EUL estimate for attic insulation is 185 years to 1,091 years. This range does not include the *ex ante* EUL estimates of 20 years for SDG&E and 25 years for PG&E. Generally, the *ex post* EUL estimates would be adopted in cases such as this where the *ex ante* estimates are not within the 80% confidence interval. We are, however, making a more conservative recommendation than that of accepting the *ex post* EUL of 319 years. This retention study occurred early in the expected EUL of attic insulation and homes themselves are not generally expected to stand 319 years. In this context, we recommend adopting the *ex ante* EUL estimates.

Similarly, the *ex ante* EUL estimate for infiltration falls outside the 80% confidence interval of the *ex post* EUL estimate. The 80% confidence interval for the *ex post* infiltration EUL estimate is 12 to 18 years. The *ex ante* EUL estimate is 10 years. Again, we recommend a conservative approach by adopting the *ex ante* EUL estimate.

In conclusion, the *ex post* EULs validate that the expected EUL is at least as long as the *ex ante* EUL. Given how early this measure retention study is compared to the expected life, we recommend the conservative approach of adopting the *ex ante* EUL estimates as the best available EULs for these program measures.

3.5 Required Protocol Tables

This subsection provides the summary tables as required in the M&E Protocols.

Table 3.10 provides the summary documentation for data quality and processing as required in Table 7 of the M&E Protocols.

Table 3.10 Data Quality and Processing Documentation
Protocol Table 7B

Protocol Table Item #	
	Overview Information
1a. Study Title & ID	Measure Retention Study for 1994/1995 Residential Weatherization Retrofit Incentives Programs for SDG&E and PG&E as per Waiver Request Approved by CADMAC August 19, 1998 for Joint Study in Lieu of Study ID Nos. 332R1 (PG&E) and 957 (SDG&E)
1b. Program, years, & descrip.	Residential Weatherization Retrofit Incentives Program [1994 for SDG&E, 1994 & 1995 for PG&E] Assistance provided for weatherization measures to be added to residential customers' homes.
1c. End uses	End Use: Space conditioning

& measures	Study measures: Attic insulation (SDG&E and PG&E) Wall insulation (PG&E), Floor insulation (PG&E), Infiltration (SDG&E)
1d. Methods & models	Site survey analysis produced retention estimates by site. Means of these are measure retention estimates. Predicted EUL estimated via exponential model using average duration and average retention. Findings of 100% retention for wall insulation and floor insulation did not allow EUL modeling. See Section 2 for further methods discussion. See Section 3 for further discussion on models and findings.
1e. Analysis sample sizes	Customers & measure installation (No. of participant homes): PG&E: Attic insulation = 5,121; Wall insulation = 885; Floor insulation = 505 SDG&E: Attic–cool insulation = 490; Infiltration–cooling = 1,534; Infiltration-heating = 1,643
	Sample sizes for Retention Analysis: Attic insulation = 194; Wall insulation = 68; Floor insulation = 34; Infiltration = 89 Sample sizes for EUL regression: Attic insulation = 383; Infiltration = 177
	Data collection: October – December, 1998
	Database Management
2a. Data sources	Program tracking databases provided information for sampling pool used as recruiting database for site visits. Site visit survey conducted as described in Section 2.
2b. Data attrition	Random sampling of customers based on strata of utility and measure was conducted with the program tracking databases to create recruitment pool. Then all measures installed were surveyed once site is recruited. Sampling plan: PG&E: 160: Attic insulation = 60; Wall insulation = 50; Floor insulation = 50 SDG&E: 90: Attic insulation - cooling = 30; Attic insulation – heating = 30; Infiltration = 30 Call disposition report provided in Table 3.1 of report. Of calls: 25% of PG&E customers scheduled and 18% of SDG&E's scheduled. Wrong numbers consisted of 20% of PG&E's calls and 39% of SDG&E's.
2c. Data quality checks	All program data pulled along with initial sampling. Each customer in sampling pool was assigned a tracking number that was used throughout recruiting, surveying, data entry and verification, and analysis phases of study. Protocols established for recruiting, site visits, utility interactions, and data entry with notebooks and training provided to project personnel. See Appendix A.
2d. Collected data not used	None

	Sampling	
3a. Sampling procedures	The sample was based upon randomly pulling customers from the program tracking databases according to a stratified sampling procedures with strata by utility and by measure. Then all measures installed at these sites eligible for surveying once site is recruited. Sampling plan: PG&E: 160: Attic insulation = 60; Wall insulation = 50; Floor insulation = 50 SDG&E: 90: Attic insulation - cooling = 30; Attic insulation – heating = 30; Infiltration = 30 Sampling frame all customers in program tracking database.	
3b. Survey information	Survey instrument provided in Appendix B. It is described in Section 2. Call disposition report provided in Table 3.1 of report. Small rate of refusal so no action taken for possible correction: less than 2%.	
3c. Statistical descrip.	Retention findings based on mean of site retention estimate by measure. Site retention estimate based on category survey response. (Category delineation indicates measurement error believed to be inherent in visual measurement technique). Infiltration retention estimate mean of retention estimates for the four elements examined in the survey. See Section 3.3. EUL estimates from exponential model using the average duration and average retention rate. See Section 3.4.	
	Data Screening and Analysis	
4a. Outliers	No outliers identified or treated. Few missing data with automatic handling in SAS®.	
4b. Background var.	None.	
4c. Screened data	No screening, all data utilized.	
4d. Model statistics	Attic insulation: Average measure age: 3.7 Proportion surviving: 0.862 EUL: 14	Infiltration: Average measure age: 3 Proportion surviving: 0.992 EUL: 319
4e. Specification	Predicted EUL = [t ln(0.5)]/ ln (S) where S=survival proportion See Section 3.4 for further detail.	
4e1 Heterogeneity	Residential program with no heterogeneity considered.	
4e2 Omitted Factors	No omissions.	
4f Error	Largest measurement error is in visual retention estimate. Explicitly incorporated what degree accuracy felt possible with this method by structuring survey questions into categories: All, Most, Half, Less than Half, and None for retention estimates. These then translated to 100%, 75%, 50%, 25%, and 0% estimates for analysis of means and for EUL estimates.	
4g Influential data points	There were few failures. Yet, these are not outliers but important components of data analysis.	
4h Missing data	Few missing data with automatic handling in SAS®.	

4i Precision	Confidence levels computed on retention rates and average measure age. Both of these used in exponential model to estimate EUL confidence levels. Measures sampling error, measurement error still significant.

Table 3.11 provides a reporting summary of the study results as required in Table 6 of the M&E Protocols.

Appendices

[Note: the format (but not the text)of some of the following appendices may differ from that of the original, published text]

A. Material from Surveyor's Guidebook

Guidebook Introduction

Megdal & Associates and ASW Engineering teamed together to conduct the Measure Retention Study for the 1994/1995 Residential Weatherization Retrofit Incentives Programs for San Diego Gas & Electric Company (SDG&E) and Pacific Gas & Electric Company (PG&E). This team combines the evaluation expertise and experience in performing retention studies of Dr. Lori Megdal with the engineering and site audit experience offered by ASW Engineering. This team is also the same team that recently completed the Statewide Direct Assistance Program (DAP) Measure Retention Study. The Surveyors Guidebook, including recruiting, data collection, and site visit protocols, for this project is essential the same as that used for the DAP project. This assisted in providing this project with experienced recruiters and auditors knowledgeable in the project procedures and in ensuring that the procedures and survey instruments were fielded consistently across auditors.

This Surveyors Guidebook contains protocols and guidelines for recruiting, site visits, data collection and utility marketing representative communications. Use of these guidelines will facilitate the successful completion of high quality work.

Objective

The purpose of this project is to conduct a Measure Retention Study for the 1994/1995 Residential Weatherization Retrofit Incentives Programs (RWRI) operated by San Diego Gas & Electric Company (SDG&E), and Pacific Gas & Electric Company (PG&E). These programs provided residential customers with assistance in adding insulation and other weatherization measures to their homes.

Utility Approach

The protocols and strategies presented herein are consistent for both utility territories. With the exception of the specific utility information sheets, all information applies for both utility territories.

Content of Each Protocol Section in Surveyor's Guidebook

The Surveyors Guidebook was divided into four sections, Recruiting Protocols, Site-Visit Protocols, Utility Marketing Rep. Protocols and Data Collection Strategies. Separate sections were provided in the Guidebook for each type of protocols:

recruiting, site visit, utility marketing representative contacts, and data collection. This was done so that project personnel performing different tasks could easily use the Guidebook as an easy reference tool after their initial training. This meant that some of the protocol items were repeated in each section. In order not to be repetitive in this documentation, only the overall content contained in the protocols is repeated here.

General Courtesy

ASW uses former utility employees who are well versed on the courtesies to offer customers as a representative of their respective utility. All telephone solicitations and personal contact will be conducted with courtesy and professionalism.

Using Utility Reference Sheet for Services the Customer May Need

It has been the experience of ASW that once a representative of a utility is available to a customer, requests for assistance in billing or complaints result. As such, ASW will provide the recruiter and surveyors with Utility Information Sheets which list the numbers of importance to help the customer and maintain the positive relationship of the utility.

Assurance That No Penalty Will Occur If Measures Are Missing

The Customer may be hesitant to participate in the program if they feel they may be penalized for removing the measure. The recruiter and the surveyor shall provide every assurance possible that this is not the case. A local utility number will be provided to the recruiter if the customer chooses to check the initial phone solicitation.

Professional Badge and Letter of Introduction

ASW will provide each surveyor with a utility specific contract badge and a formal Letter of Introduction from the specific utility.

Utility Marketing Representatives Communication Protocols

ASW will provide a central point of contact for all Utility Marketing Reps to maximize all communications.

The Surveyor's Guidebook provided contact information for each step in the recruiting, site visit, and data process. All of the utility study managers were listed along with their contract information. An Appendix in the Surveyor's Guidebook provided the list of utility contacts for ASW's provision of appropriate contacts to assistance with other customer service issues.

Incentives

ASW will offer each household the option of a $5 coupon for Blockbuster Video or a $5 coupon to McDonalds for participating in the program. These coupons will be issued on site after the survey is complete.

Unusual Questions

All unanticipated questions or concerns should be immediately brought to the program managers attention.

Additional Recruiting Protocols

ASW will utilize a qualified recruiter with 20 years experience to make initial phone calls describing the project. The recruiter, with the use of a generalized script, will request an on site visit. The recruiter will solicit or provide the following information:

- Verification of address and current residents name,
- Explanation of the project and the need for tracking measures,
- Description of $5 Blockbuster coupon or $5 McDonalds coupon offered as an incentive,
- Guidance on the expected on-site length of the survey,
- Procedures on-site surveyor will use, i.e., visual,
- Assurance that the removal of a measure will not have a penalty,
- Best time of day to provide survey.

If a site visit is agreed to, an estimated week and hour of day will be established. The recruiter will then group multiple sites together to minimize travel time for the surveyors. All surveyor will verify the exact time approximately 24 hours prior to the site visit.

The purpose of this script is to provide a general procedure for recruitment. ASW understands the level of experience our recruiter has and as such provides this as a guideline only. The guideline recruiting script is as follows:

> "Good Morning, may I speak to Mr./Mrs. _____?
>
> My name is _____ and I represent ASW Engineering who is on contract to _____ [FILL IN APPROPRIATE UTILITY], your utility.
>
> Several years ago, _____ [FILL IN APPROPRIATE UTILITY], along with other utilities in California, conducted the Residential Weatherization Retrofit Incentives Program whereby the Utility provided

assistance in having insulation or other weatherization measures installed in residential homes.

The utilities are required to verify the effectiveness of this program and ascertain whether or not these products are still in place. We realize that there are some circumstances when the measures may be removed. And for your information, there is no penalty for removal of any of these measures.

The whole verification along with several questions and answers should take no longer than a half an hour. We would like to be able to schedule an on-site survey to accomplish this and will compensate your cooperation with your choice of a $5 coupon for use at Blockbuster Video or $5 McDonald's coupon.

If you will give me the best time of day for the appointment and which week will be best for you, a surveyor from ASW will be calling you to schedule an appointment within the next 2 weeks.

Do you have any questions that I may be able to answer at this time?

Thank you very much for your cooperation."

Further guidelines for recruiting were:

- Each contact made with the customer will be recorded in the Data Collection Database. Any problems or difficulties will be noted and reported to the Project Manager. Entry of this information into the Database will allow easy tracking and automatic disposition of logs.
- ASW will contact each household 4 times before discontinuing attempts to include household. Efforts shall be made to contact at different times of day and possibly weekends to maximize opportunities for recruitment.

Additional Site Survey Protocols

Each surveyor will provide an introduction showing identification badge and reference the recruiting interview, explanation of the purpose of the survey, and mention of the energy information incentive. The letter of introduction is also available if needed.

B. Site Visit Survey Instrument

October 13, 1998

Site Visit Survey for the Retention Study of the RWRI Program -- SDG&E

Utility_____ ASW Tracking #__ Surveyor Initials __ Survey ID Date ____

Customer Name	
Contact for Visit	
Street Address	
City	
Zip	
Phone number(s)	
Account #	
Schedule Date & Time	
Other Scheduling Notes	

From sample database (1=Yes, 0=No)

SDG&E
Infiltration – cooling _____
Attic Insulation _____
Infiltration – heating _____

Q1 Were you the owner in 1994? Yes ___ No ____

Attic Insulation

[AS A RETENTION STUDY, WE ARE ONLY INTERESTED IN THE PROPORTION REMAINING IN PLACE. NOT THE PROPORTION COVERED INITIALLY]

Q2 What proportion of the **attic insulation** is still in place (of that you can tell was originally there)? **[If "All" skip Q3 & Q4]**

All _____ Most ____Half ____Less than half___ None____

Q3 When was the attic insulation removed? [ASK CUSTOMER]
Month ____ Year ___

Q4 Why was it removed?

_____

[ASK CUSTOMER]

Page I of 2

October 13, 1998

Infiltration

Q15 What proportion of **window caulking** is still in place (of that you can tell was originally there)?

All _____ Most ____ Half _____ Less than Half ____ None ___ Never Installed ____

Q16 What proportion of **weatherstripping on exterior doors** is still in place (of that you can tell was originally there)?

All _____ Most ____ Half _____ Less than Half ____ None ___ Never Installed ____

Q17 What proportion of **electrical outlet insulation (switches and receptacles)** are still in place (of that you can tell was originally there)?

All _____ Most ____ Half _____ Less than Half ____ None ___ Never Installed ____

Q18 What proportion of **sealing on bypass** (sealing on plumbing accesses & special openings) are still in place (of that you can tell was originally there)?

All _____ Most ____ Half _____ Less than Half ____ None ___ Never Installed ____

NOTES:

October 13 1998

Site Visit Survey for the Retention Study of the RWRI Program -- PG&E

Utility ___ ASW Tracking # ___ Surveyor Initials ____ Survey Date ____

Customer Name	
Contact for Visit	
Street Address	
City	
Zip	
Phone number(s)	
Account#	Control # (PG&E)
Schedule Date & Time	
Other Scheduling Notes	

From sample database (I=Yes, O=No)

PG&E

Attic Insulation _____

Wall Insulation _____

Floor Insulation _____

Q I Were you the owner in 1994?

Yes ____ No _____

Attic Insulation

[AS A RETENTION STUDY, WE ARE ONLY INTERESTED IN THE PROPORTION REMAINING IN PLACE. NOT TBE PROPORTION COVERED INITIALLY.]

Q2 What proportion of the **attic insulation** is still in place (of that you can tell was originally there)? **[If "All" skip Q3 & Q4]**

All _____ Most ____Half ____Less than half___ None____

Q3 When was the attic insulation removed? [ASK CUSTOMER]

Month _____ Year ____

Q4 Why was it removed? _____
[ASK CUSTOMER]

Page I of 3

October 13, '1998

Wall Insulation

[ASK CUSTOMER]

Q5 Have the walls that were insulated in the program been reconstructed as part of a repair or remodeling effort? **[if "No" skip Q6, Q8 & Q9]**

All___ Some___ No____I don't Know [ASK CUSTOMER]

Q6 What proportion of the **wall insulation** installed through the program is still in place?

All _____ Most ____Half ____Less than half___ None____

Q7 GIVEN THE ABOVE, AND WHAT THE AUDITOR OBSERVES ON SITE: What proportion of the insulation installed through the program is still in place?

All _____ Most ____Half ____Less than half___ None____
[if "All" skip Q8 & Q9]

Q8 When was the wall insulation removed? [ASK CUSTOMER]

Month____ Year_____

Q9 Why was it removed?
[ASK CUSTOMER]

October '1998

Floor Insulation

[ASK CUSTOMER]

Q10 Have the floors that were insulated in the program been reconstructed as part of a repair or remodeling effort? [If "No" skip Q11, Q13 & Q141
All _____ Some _____ No ____ Don't Know _____

[ASK CUSTOMER]

Qll What proportion of the **floor insulation** installed through the program is still in place?

All _____ Most ____Half ____Less than half___ None____

Q12 GIVEN THE ABOVE, AND WHAT THE AUDITOR OBSERVES ON SITE: What proportion of the insulation installed through the program is still in place?
[if "All" skip Q13 & Q141

All _____ Most ____Half ____Less than half___ None____

Q13 When was the floor insulation removed? [ASK CUSTOMER]
Month _____ Year _____

Q14 Why was it removed? _____
[ASK CUSTOMER]

NOTES:

C. Site Survey Findings

COUNTS FROM SITE SURVEYS

ATTC_INS	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	56	22.4	56	22.4
1	194	77.6	250	100.0

WALL_INS	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	182	72.8	182	72.8
1	68	27.2	250	100.0

FLR_INS	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	216	86.4	216	86.4
1	34	13.6	250	100.0

INF_CLG	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	167	66.8	167	66.8
1	83	33.2	250	100.0

INF_HTG	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	172	68.8	172	68.8
1	78	31.2	250	100.0

COUNTS FROM SITE SURVEYS

INFILTR	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	161	64.4	161	64.4
1	89	35.6	250	100.0

PG_E	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	90	36.0	90	36.0
1	160	64.0	250	100.0

SDG_E	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	160	64.0	160	64.0
1	90	36.0	250	100.0

COUNTS BY UTILITY FOR ATTIC INSULATION

TABLE OF ATTC_INS BY PG_E

ATTC_INS / PG_E	SDG&E	PG&E	Total
0	27	29	56
	10.80	11.60	22.40
	48.21	51.79	
	30.00	18.13	
1	63	131	194
	25.20	52.40	77.60
	32.47	67.53	
	70.00	81.88	
Total	90	160	250
	36.00	64.00	100.00

SURVEY FREQUENCIES

Were you the owner in 1994?

Q1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Yes	229	92.7	229	92.7
No	18	7.3	247	100.0

Frequency Missing = 3

What % of attic insul still in place?

Q2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	179	93.2	179	93.2
Most	10	5.2	189	98.4
Half	1	0.5	190	99.0
Less than half	1	0.5	191	99.5
None	1	0.5	192	100.0

Frequency Missing = 58

SURVEY FREQUENCIES

TABLE OF Q3M BY Q3Y

Q3M(What month was the attic insul removed?)
Q3Y(What year was the attic insul removed?)

Frequency, Percent , Row Pct , Col Pct	1998	Total
8	1	1
	100.00	100.00
	100.00	
	100.00	
Total	1	1
	100.00	100.00

Frequency Missing = 249

Why was the attic insulation removed?

Q4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Remodel	1	100.0	1	100.0

Frequency Missing = 249

Have the insul walls been remodeled?

Q5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	2	2.9	2	2.9
Some	1	1.4	3	4.3
No	65	94.2	68	98.6
Do not know	1	1.4	69	100.0

Frequency Missing = 181

SURVEY FREQUENCIES

Cust: % of wall insul still in place?

Q6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	17	100.0	17	100.0

Frequency Missing = 233

Auditor: % wall insul still in place?

Q7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	66	100.0	66	100.0

Frequency Missing = 184

For Q8M*Q8Y
all data are missing since all
the levels of variable Q8M are missing.

Why was the wall insulation removed?

Q9	Frequency	Percent	Cumulative Frequency	Cumulative Percent

Frequency Missing = 250

SURVEY FREQUENCIES

Have insul floor been remodeled?

Q10	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	35	100.0	35	100.0

Frequency Missing = 215

Cust: % floor insul still in place?

Q11	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	19	100.0	19	100.0

Frequency Missing = 231

Auditor: % floor insul still in place?

Q12	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	34	100.0	34	100.0

Frequency Missing = 216

For Q13M*Q13Y
all data are missing since all
the levels of variable Q13M are missing.

SURVEY FREQUENCIES

Why was the floor insulation removed?

Q14	Frequency	Percent	Cumulative Frequency	Cumulative Percent

Frequency Missing = 250

What % of the window caulkingin place?

Q15	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	52	59.8	52	59.8
Most	11	12.6	63	72.4
Half	5	5.7	68	78.2
Less than half	1	1.1	69	79.3
None	4	4.6	73	83.9
Never installed	14	16.1	87	100.0

Frequency Missing = 163

% weatherstripping on ext doors?

Q16	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	70	78.7	70	78.7
Most	6	6.7	76	85.4
Half	8	9.0	84	94.4
Less than half	4	4.5	88	98.9
None	1	1.1	89	100.0

Frequency Missing = 161

SURVEY FREQUENCIES

% elec outlet insulation in place?

Q17	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	49	55.1	49	55.1
Most	20	22.5	69	77.5
Half	15	16.9	84	94.4
Less than half	2	2.2	86	96.6
None	3	3.4	89	100.0

Frequency Missing = 161

What % of sealing on bypass in place?

Q18	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	48	53.9	48	53.9
Most	4	4.5	52	58.4
Less than half	1	1.1	53	59.6
None	4	4.5	57	64.0
Never installed	32	36.0	89	100.0

Frequency Missing = 161

FREQUENCIES FOR ONLY THOSE INSTALLED FOR Q15-Q18

What % of the window caulkingin place?

Q15	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	52	71.2	52	71.2
Most	11	15.1	63	86.3
Half	5	6.8	68	93.2
Less than half	1	1.4	69	94.5
None	4	5.5	73	100.0

Frequency Missing = 177

% weatherstripping on ext doors?

Q16	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	70	78.7	70	78.7
Most	6	6.7	76	85.4
Half	8	9.0	84	94.4
Less than half	4	4.5	88	98.9
None	1	1.1	89	100.0

Frequency Missing = 161

% elec outlet insulation in place?

Q17	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	49	55.1	49	55.1
Most	20	22.5	69	77.5
Half	15	16.9	84	94.4
Less than half	2	2.2	86	96.6
None	3	3.4	89	100.0

Frequency Missing = 161

FREQUENCIES FOR ONLY THOSE INSTALLED FOR Q15-Q18

What % of sealing on bypass in place?

Q18	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	48	84.2	48	84.2
Most	4	7.0	52	91.2
Less than half	1	1.8	53	93.0
None	4	7.0	57	100.0

Frequency Missing = 193

WEIGHTED ATTIC INSULATION FREQUENCY

What % of attic insul still in place?

Q2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All	187.8011	97.6	187.8011	97.6
Most	3.77187	2.0	191.573	99.6
Half	0.26892	0.1	191.8419	99.7
Less than half	0.26892	0.1	192.1108	99.9
None	0.26892	0.1	192.3797	100.0

Frequency Missing = 48.07746

D. Means, Statistics, and Estimates for the Retention and Effective Useful Life (EUL) Analyses

ATTIC INSULATION RETENTION RATE & AVERAGED WEIGHTED DURATION

Variable	N	Mean	Std Dev	Minimum	Maximum
Q2_RET	192	0.9919532	0.0609996	0	1.0000000
DUR	250	3.7082356	0.4467085	3.0000000	4.0000000

ATTIC INSULATION RETENTION RATE BY YEAR

Analysis Variable : Q2_RET

YEAR=94

N	Mean	Std Dev	Minimum	Maximum
108	0.9976852	0.0279673	0.7500000	1.0000000

YEAR=95

N	Mean	Std Dev	Minimum	Maximum
84	0.9739239	0.0855267	0	1.0000000

RETENTION RATES FOR INFILTRATION MEASURES

Variable	N	Mean	Std Dev	Minimum	Maximum
Q15_RET	73	0.8630137	0.2669305	0	1.0000000
Q16_RET	89	0.8932584	0.2289044	0	1.0000000
Q17_RET	89	0.8089888	0.2584440	0	1.0000000
Q18_RET	57	0.8991228	0.2749174	0	1.0000000
INF_RET	89	0.8623596	0.1778786	0.1875000	1.0000000

STATISTICS FOR INFILTRATION RETENTION RATES

Univariate Procedure

Variable=Q15_RET

Moments

N	73	Sum Wgts	73
Mean	0.863014	Sum	63
Std Dev	0.266931	Variance	0.071252
Skewness	-2.19452	Kurtosis	4.20657
USS	59.5	CSS	5.130137
CV	30.93004	Std Mean	0.031242
T:Mean=0	27.62364	Pr>|T|	0.0001
Num ^= 0	69	Num > 0	69
M(Sign)	34.5	Pr>=|M|	0.0001
Sgn Rank	1207.5	Pr>=|S|	0.0001

Quantiles(Def=5)

100% Max	1	99%	1
75% Q3	1	95%	1
50% Med	1	90%	1
25% Q1	0.75	10%	0.5
0% Min	0	5%	0
		1%	0
Range	1		
Q3-Q1	0.25		
Mode	1		

Extremes

Lowest	Obs	Highest	Obs
0(	205)	1(	245)
0(	176)	1(	246)
0(	172)	1(	247)
0(	161)	1(	249)
0.25(	194)	1(	250)

Missing Value	.
Count	177
% Count/Nobs	70.80

STATISTICS FOR INFILTRATION RETENTION RATES

Univariate Procedure

Variable=Q16_RET

Moments

N	89	Sum Wgts	89
Mean	0.893258	Sum	79.5
Std Dev	0.228904	Variance	0.052397
Skewness	-2.12888	Kurtosis	3.650111
USS	75.625	CSS	4.610955
CV	25.62577	Std Mean	0.024264
T:Mean=0	36.81442	Pr>|T|	0.0001
Num ^= 0	88	Num > 0	88
M(Sign)	44	Pr>=|M|	0.0001
Sgn Rank	1958	Pr>=|S|	0.0001

Quantiles(Def=5)

100% Max	1	99%	1
75% Q3	1	95%	1
50% Med	1	90%	1
25% Q1	1	10%	0.5
0% Min	0	5%	0.25
		1%	0
Range	1		
Q3-Q1	0		
Mode	1		

Extremes

Lowest	Obs	Highest	Obs
0(	161)	1(	244)
0.25(	250)	1(	245)
0.25(	194)	1(	246)
0.25(	170)	1(	247)
0.25(	163)	1(	249)

Missing Value	.
Count	161
% Count/Nobs	64.40

STATISTICS FOR INFILTRATION RETENTION RATES

Univariate Procedure

Variable=Q17_RET

Moments

N	89	Sum Wgts	89
Mean	0.808989	Sum	72
Std Dev	0.258444	Variance	0.066793
Skewness	-1.37568	Kurtosis	1.482757
USS	64.125	CSS	5.877809
CV	31.94655	Std Mean	0.027395
T:Mean=0	29.53052	Pr>|T|	0.0001
Num ^= 0	86	Num > 0	86
M(Sign)	43	Pr>=|M|	0.0001
Sgn Rank	1870.5	Pr>=|S|	0.0001

Quantiles(Def=5)

100% Max	1	99%	1
75% Q3	1	95%	1
50% Med	1	90%	1
25% Q1	0.75	10%	0.5
0% Min	0	5%	0.25
		1%	0
Range	1		
Q3-Q1	0.25		
Mode	1		

Extremes

Lowest	Obs	Highest	Obs
0(	205)	1(	241)
0(	186)	1(	242)
0(	167)	1(	245)
0.25(	243)	1(	249)
0.25(	176)	1(	250)

Missing Value	.
Count	161
% Count/Nobs	64.40

STATISTICS FOR INFILTRATION RETENTION RATES

Univariate Procedure

Variable=Q18_RET

Moments

N	57	Sum Wgts	57
Mean	0.899123	Sum	51.25
Std Dev	0.274917	Variance	0.07558
Skewness	-2.80115	Kurtosis	6.571051
USS	50.3125	CSS	4.232456
CV	30.57618	Std Mean	0.036414
T:Mean=0	24.69188	Pr>|T|	0.0001
Num ^= 0	53	Num > 0	53
M(Sign)	26.5	Pr>=|M|	0.0001
Sgn Rank	715.5	Pr>=|S|	0.0001

Quantiles(Def=5)

100% Max	1	99%	1
75% Q3	1	95%	1
50% Med	1	90%	1
25% Q1	1	10%	0.75
0% Min	0	5%	0
		1%	0
Range	1		
Q3-Q1	0		
Mode	1		

Extremes

Lowest	Obs	Highest	Obs
0(	211)	1(	236)
0(	191)	1(	241)
0(	177)	1(	247)
0(	176)	1(	249)
0.25(	217)	1(	250)

Missing Value	.
Count	193
% Count/Nobs	77.20

STATISTICS FOR INFILTRATION RETENTION RATES

Univariate Procedure

Variable=INF_RET

Moments

N	89	Sum Wgts	89
Mean	0.86236	Sum	76.75
Std Dev	0.177879	Variance	0.031641
Skewness	-1.4985	Kurtosis	1.888418
USS	68.97049	CSS	2.784391
CV	20.62697	Std Mean	0.018855
T:Mean=0	45.73615	Pr>|T|	0.0001
Num ^= 0	89	Num > 0	89
M(Sign)	44.5	Pr>=|M|	0.0001
Sgn Rank	2002.5	Pr>=|S|	0.0001

Quantiles(Def=5)

100% Max	1	99%	1
75% Q3	1	95%	1
50% Med	0.916667	90%	1
25% Q1	0.8125	10%	0.5625
0% Min	0.1875	5%	0.5
		1%	0.1875
Range	0.8125		
Q3-Q1	0.1875		
Mode	1		

Extremes

Lowest	Obs	Highest	Obs
0.1875(	176)	1(	236)
0.375(	243)	1(	237)
0.5(	205)	1(	241)
0.5(	194)	1(	245)
0.5(	177)	1(	249)

Missing Value	.
Count	161
% Count/Nobs	64.40

Exponential EUL Equation

	Infiltration	Attic insul
Avg. Measure Age	3	3.7
Proportion Surviving	0.862	0.992
EUL	14.00297256	319.2965321

Attic Insulation

Mean = .991953
N= 192 Scale adjustment
SD = 0.061 0.061494 = SD
Conf. Intrvl 80% conf.

0.005687495 98% 99.8%

Infiltration

Mean = 0.86236
N= 89 Scale Adjustment
SD = 0.177879 0.20627 = SD
Conf. Intrvl 80% conf.
0.028020516 83.4% 89.0%

Duration

Mean = 3.708236
N= 250 Scale Adjustment
SD= 0.446709 0.120464 = SD
Conf. Intrv 80%
0.009764 3.70 3.72

Use Low duration with low retention and higher with higher for maximum confidence interval

	Infiltration		**Attic Insul**	
	Low	High	Low	High
Average Measure Age	3	3	3.70	3.72
Proportion Surviving	83.4%	89.0%	98.6%	99.8%
EUL	11.5	17.9	185.4	1,091.0

E. Datasets and Documentation

This study was specifically designed to be as simple and straight forward as possible. As the analysis progressed, the steps and programs were continually refined in order to accomplish this goal. The result was the development of small set of concise data analysis steps. The use of these steps, and copies of the programs are provided in this Appendix. The datasets, SAS© programs, and Excel© spreadsheets are provided on diskette at the end of this Appendix. Following the description contained below, the work should be easily replicable.

Flow of Datasets and Analysis Programs

A step-by-step schematic of the use of datasets and analysis programs is presented in Figure E.1. This diagram also indicates the complete flow of the material provided and the type of material (dataset and type, program and type). This diagram can be used with the datasets and programs provided on diskette to replicate all of the results discussed in this report.

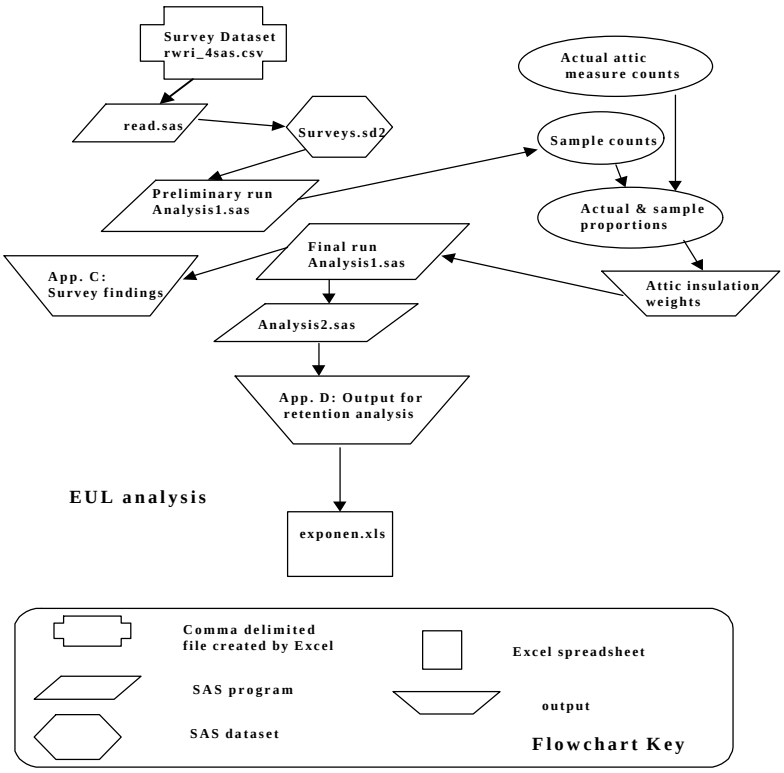
Printed copies of each of the SAS© programs and Excel© spreadsheets are provided in the pages following the flow chart. They are provided in the order that they are used.

Set-Up Reminders for Replication

The SAS© and Excel© programs are the exact ones used for this study. A few minor changes will need to be made to replicate the work.

SAS© programs contain LIBNAME statements and FILENAME statements in the beginning of the programs to tell the program where to find datasets and where to place datasets. These will need to be changed to reflect the folder set-up being used in the replication.

Figure E.1


Survey Dataset
rwri_4sas.csv
read.sas
Surveys.sd2
Preliminary run
Analysis1.sas
Actual attic
measure counts
Sample counts
Actual & sample
proportions
Attic insulation
weights
Final run
Analysis1.sas
App. C:
Survey findings
Analysis2.sas
App. D: Output for
retention analysis
EUL analysis
exponen.xls
Comma delimited
file created by Excel
SAS program
SAS dataset
Excel spreadsheet
output
Flowchart Key

```
LIBNAME RWRI 'C:\LORI\SDGE_RET\ANALYSIS\RET';

FILENAME RAW 'C:\LORI\SDGE_RET\ANALYSIS\RET\IN_DATA\RWRI_4SAS.CSV';


DATA RWRI.SURVEYS;
  INFILE RAW DSD;
  LENGTH Q4 Q9 Q14 $ 20.;
  INPUT ASW_NO Q1 Q2 Q3M Q3Y Q4 $ Q5 Q6 Q7 Q8M Q8Y Q9 $ Q10 Q11 Q12
     Q13M Q13Y Q14 $ Q15 Q16 Q17 Q18 ATTC_INS WALL_INS FLR_INS INF_CLG
INF_HTG
     YEAR PG_E SDG_E;
RUN;

PROC PRINT;
RUN;
```

```
LIBNAME RWRI 'C:\LORI\SDGE_RET\ANALYSIS\RET';


OPTIONS PS=50 LS=80 NODATE NONUMBER;


DATA SURVEY;

   SET RWRI.SURVEYS;

   IF INF_CLG=1 OR INF_HTG=1 THEN INFILTR=1; ELSE INFILTR=0;
   LABEL Q1='Were you the owner in 1994?';
   LABEL Q2='What % of attic insul still in place?';
   LABEL Q3M='What month was the attic insul removed?';
   LABEL Q3Y='What year was the attic insul removed?';
   Label Q4='Why was the attic insulation removed?';
   Label Q5='Have the insul walls been remodeled?';
   Label Q6='Cust: % of wall insul still in place?';
   Label Q7='Auditor: % wall insul still in place?';
   Label Q8M='What month was the wall insul removed?';
   Label Q8Y='What year was the wall insul removed?';
   Label Q9='Why was the wall insulation removed?';
   Label Q10='Have insul floor been remodeled?';
   Label Q11='Cust: % floor insul still in place?';
   Label Q12='Auditor: % floor insul still in place?';
   Label Q13M='What month was floor insulat removed?';
   Label Q13Y='What year was floor insulat removed?';
   Label Q14='Why was the floor insulation removed?';
   Label Q15='What % of the window caulkingin place?';
   Label Q16='% weatherstripping on ext doors?';
   Label Q17='% elec outlet insulation in place?';
   Label Q18='What % of sealing on bypass in place?';
   IF PG_E=1 THEN ATTC_WGT=1.35159;
   IF SDG_E=1 THEN ATTC_WGT=0.26892;
RUN;

PROC FORMAT;
   VALUE ANSR_A   1='All'
                  2='Most'
                  3='Half'
                  4='Less than half'
                  5='None';

   VALUE ANSR_B   1='Yes'
                  2='No';

   VALUE ANSR_C   1='All'
                  2='Most'
                  3='Half'
                  4='Less than half'
                  5='None'
                  6='Never installed';

   VALUE ANSR_D   1='All'
                  2='Some'
                  3='No'
                  4= 'Do not know';
```

```
   VALUE ANSR_PGE 1='PG&E'
                  0='SDG&E';

RUN;

PROC FREQ;
  TABLES ATTC_INS WALL_INS FLR_INS INF_CLG INF_HTG INFILTR PG_E SDG_E;
  TITLE 'COUNTS FROM SITE SURVEYS';
RUN;

PROC FREQ;
  TABLES  ATTC_INS*PG_E;
  FORMAT PG_E ANSR_PGE.;
  TITLE 'COUNTS BY UTILITY FOR ATTIC INSULATION';
RUN;

PROC FREQ;
  TABLES Q1 Q2 Q3M*Q3Y Q4 Q5 Q6 Q7 Q8M*Q8Y Q9 Q10 Q11 Q12 Q13M*Q13Y Q14
         Q15 Q16 Q17 Q18;
  FORMAT Q1 ANSR_B. Q2 Q6 Q7 Q11 Q12 ANSR_A. Q5 Q10 ANSR_D. Q15 Q16 Q17
Q18 ANSR_C.;
  TITLE 'SURVEY FREQUENCIES';
RUN;

DATA SURVEY2;
   SET SURVEY;
   IF Q15=6 THEN Q15=.;
   IF Q16=6 THEN Q16=.;
   IF Q17=6 THEN Q17=.;
   IF Q18=6 THEN Q18=.;
RUN;

PROC FREQ DATA=SURVEY2;
  TABLES Q15 Q16 Q17 Q18;
  FORMAT Q15 Q16 Q17 Q18 ANSR_C.;
  TITLE 'FREQUENCIES FOR ONLY THOSE INSTALLED FOR Q15-Q18';
RUN;

PROC FREQ DATA=SURVEY;
  TABLES Q2;
  WEIGHT ATTC_WGT;
  FORMAT Q2 ANSR_A.;
  TITLE 'WEIGHTED ATTIC INSULATION FREQUENCY';
RUN;
```

```
LIBNAME RWRI 'C:\LORI\SDGE_RET\ANALYSIS\RET';

OPTIONS PS=50 LS=80 NODATE NONUMBER;

DATA SURVEY;
   SET RWRI.SURVEYS;
   IF INF_CLG=1 OR INF_HTG=1 THEN INFILTR=1; ELSE INFILTR=0;
   LABEL Q1='Were you the owner in 1994?';
   LABEL Q2='What % of attic insul still in place?';
   LABEL Q3M='What month was the attic insul removed?';
   LABEL Q3Y='What year was the attic insul removed?';
   Label Q4='Why was the attic insulation removed?';
   Label Q5='Have the insul walls been remodeled?';
   Label Q6='Cust: % of wall insul still in place?';
   Label Q7='Auditor: % wall insul still in place?';
   Label Q8M='What month was the wall insul removed?';
   Label Q8Y='What year was the wall insul removed?';
   Label Q9='Why was the wall insulation removed?';
   Label Q10='Have insul floor been remodeled?';
   Label Q11='Cust: % floor insul still in place?';
   Label Q12='Auditor: % floor insul still in place?';
   Label Q13M='What month was floor insulat removed?';
   Label Q13Y='What year was floor insulat removed?';
   Label Q14='Why was the floor insulation removed?';
   Label Q15='What % of the window caulking in place?';
   Label Q16='% weatherstripping on ext doors?';
   Label Q17='% elec outlet insulation in place?';
   Label Q18='What % of sealing on bypass in place?';
   IF PG_E=1 THEN ATTC_WGT=1.35159;
   IF SDG_E=1 THEN ATTC_WGT=0.26892;
RUN;

PROC FORMAT;
   VALUE ANSR_A   1='All'
                  2='Most'
                  3='Half'
                  4='Less than half'
                  5='None';

   VALUE ANSR_B   1='Yes'
                  2='No';

   VALUE ANSR_C   1='All'
                  2='Most'
                  3='Half'
                  4='Less than half'
                  5='None'
                  6='Never installed';

   VALUE ANSR_D   1='All'
                  2='Some'
                  3='No'
                  4= 'Do not know';

   VALUE ANSR_PGE 1='PG&E'
                  0='SDG&E';
RUN;

DATA SURVEY2;
```

```
   SET SURVEY;
   IF Q15=6 THEN Q15=.;
   IF Q16=6 THEN Q16=.;
   IF Q17=6 THEN Q17=.;
   IF Q18=6 THEN Q18=.;
   Q2_RET=(5-Q2)*0.25;
   Q15_RET=(5-Q15)*0.25;
   Q16_RET=(5-Q16)*0.25;
   Q17_RET=(5-Q17)*0.25;
   Q18_RET=(5-Q18)*0.25;
   INF_RET=MEAN(Q15_RET,Q16_RET,Q17_RET,Q18_RET);
   DUR=98-YEAR;
RUN;

PROC MEANS DATA=SURVEY2;
  VAR Q2_RET DUR;
  WEIGHT ATTC_WGT;
  TITLE 'ATTIC INSULATION RETENTION RATE & AVERAGED WEIGHTED DURATION';
RUN;

PROC SORT;  BY YEAR; RUN;

PROC MEANS;
  VAR Q2_RET;
  WEIGHT ATTC_WGT;
  BY YEAR;
  TITLE 'ATTIC INSULATION RETENTION RATE BY YEAR';
RUN;


PROC MEANS DATA=SURVEY2;
  VAR Q15_RET Q16_RET Q17_RET Q18_RET INF_RET;
  TITLE 'RETENTION RATES FOR INFILTRATION MEASURES';
RUN;

PROC UNIVARIATE;
  VAR Q15_RET Q16_RET Q17_RET Q18_RET INF_RET;
  TITLE 'STATISTICS FOR INFILTRATION RETENTION RATES';
RUN;
```

F.Fourth Year Retention Study Waiver

PACIFIC GAS & ELECTRIC and SAN DIEGO GAS & ELECTRIC
WAIVER REQUEST FOR
1994 and 1995 RESIDENTIAL
WEATHERIZATION RETROFIT INCENTIVES PROGRAMS
(Study ID Nos. 332R (PG&E) and 957 (SDG&E))

Approved by CADMAC on August 19, 1998

REQUEST

PG&E and SDG&E request a waiver for the PY94/PY95 Residential Weatherization Retrofit Incentives (RWRI) Program fourth year retention study required by Table 8A of the Protocols. PG&E and SDG&E propose to conduct a joint study for this program in lieu of individual utility studies.

BACKGROUND

PG&E conducted this program **in-house,** and SDG&E conducted this program through its pilot Bidding Program. The following table shows the benefits from this program.

Utility	Program Years	Total Resource Benefits	Earnings
PG&E	1994 & 1995	$7,509,000	($39,000)'
SDG&E	1995	$569,756	$173,000

[1]*PG&E paid a penalty for the PY94 RWRI Program*

RATIONALE

PG&E and SDG&E believe that the measures required to be included for the fourth year retention studies are most likely to still be in place and operable. In order to verify this claim, it would be costeffective for the utilities to combine their verification efforts into one study. The cost savings will result from having a combined representative sample for both utilities.

The following table lists the measures that have been identified as meeting the "top 50% of resource benefits" requirement specified in Table 9A of the M&E Protocols. These measures account for 69% for PG&E and 62% for SDG&E of the total resource benefits of the program.

Utility	Measures	% of Total Resource Benefits	No. of Participant Homes
PG&E	Attic Insulation (electric & gas)	37%	5,121
PG&E	Wall Insulation (electric & gas)	11%	885
PG&E	Floor Insulation (electric & gas)	19%	505
SDG&E	Infiltration-cooling (electric)	27%	1,534
SDG&E	Attic-cool insulation (electric)	20%	490
SDG&E	Infiltration-heating (gas)	15%	1,643

CONCLUSION

PG&E and SDG&E believe that it is reasonable to assume that the identified "top 50% of resource benefits" measures are still installed and operable and that it would be more cost-effective to conduct a joint fourth year retention study for this program. Therefore, PG&E and SDG&E are requesting that they be granted a waiver to conduct a joint PY95 fourth year retention study the RWRI Program.

s:\share\cadmac\waivers\py95\rwriret3.doc