IMPROVING THE STANDARD PERFORMANCE CONTRACTING PROGRAM: AN EXAMINATION OF THE HISTORICAL EVIDENCE AND DIRECTIONS FOR THE FUTURE

FINAL REPORT

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ES EXECUTIVE SUMMARY

E.1 BACKGROUND

Under the 1998 Nonresidential Standard Performance Contract (NSPC) Program and the 1999 Large Nonresidential Standard Performance Contract (LNSPC) Program (both hereafter referred to simply as the SPC Program), the program administrators (Pacific Gas & Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company) offered a fixed-price incentive to end users or third-party energy-efficiency service providers (EESPs) for measured kilowatt-hour (kWh) energy savings achieved by the installation of an energy-efficiency project. The fixed price per kWh saved, performance measurement protocols, payment terms, and all other operating rules of the program are specified in a standard contract.

The SPC Program is a "pay-for-performance" program. The utility pays a variable incentive amount to a third-party EESP, or to a customer acting as their own EESP, based on measured energy savings using a mutually agreed upon measurement protocol. The SPC Program is also different from traditional utility rebate programs in that the total incentive is paid over an extended 2-year performance period.

To qualify for the SPC Program, a project must produce a minimum level of kWh savings per year. Eligible energy-efficiency technologies ("measures") include, but are not limited to, replacement of standard fluorescent lighting with high-efficiency fluorescent lighting, installation of variable-speed drives on electric motors, installation of lighting controls to reduce lighting operating hours, and replacement of standard-efficiency air conditioning equipment with high-efficiency equipment.

Both the 1998 and 1999 SPC Programs were evaluated using the self-report approach, which is described in the *Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs*. As its name implies, this approach is used to estimate net-to-gross ratios (NTGRs) based only on participants' self reports regarding the influence of a DSM program on their decision to install energy-efficient measures.

Using the self-report method, the NTGRs for the 1998 and 1999 SPC Programs are both 0.53. Thus, it appears that slightly less than half of the energy savings from the projects associated with these two programs are likely to have occurred in the absence of the program. This report addresses the concern that these relatively low NTGRs reduce the available kWh and kW in the DSM portfolio, utility earnings, and the cost-benefit ratio for the SPC Program.

E.2 RESEARCH OBJECTIVES

The four major research objectives are:

1. To investigate why the SPC Program has such a relatively high rate of freeridership:

   - To assess how program features or targeting could be changed to reduce the rate of freeridership, and

   - To investigate which customer and project characteristics seem to be associated with high or low freeridership.

2. To investigate the accuracy and stability of the NTGRs estimated for the 1998 and 1999 SPC Program and assess whether particular survey questions seem to be driving the freeridership result.

3. To determine whether the self-report approach to estimating NTGRs is systematically biased.

4. To assess the affect of the recent, dramatic increase in electricity prices on NTGRs and the total resource cost (TRC) test .

E.3 METHODS

The methods used to address these research objectives were both quantitative and qualitative and involved the following:

1. An analysis of the 1998 and 1999 SPC data
2. A meta-analysis of evaluation studies filed with the California Public Utilities Commission (CPUC) by California by investor-owned utilities between 1994 and 1998
3. An analysis of actual evaluation datasets for a subset of 16 studies filed with the CPUC by California by investor-owned utilities between 1994 and 1998
4. A review of the inputs to the TRC.

E.4 FINDINGS AND RECOMMENDATIONS

The research objectives established for this study will serve as the framework for presenting the findings and recommendations.

E.4.1 Objective 1: Exploration of the Reasons for High Freeridership

Findings

- In the 1998 and 1999 SPC Programs, we found that:

  - Lighting projects accounted for 58 percent of the measures installed, followed by HVAC with 22 percent
  - Lighting has an average NTGR of 0.40, which is the lowest of all end uses

  - Commercial customers tend overwhelmingly to use the services of an EESP
  - Projects sponsored by EESPs tend to have higher NTGRs.

- Regression analysis of the 1998 and 1999 SPC Programs revealed that both the number of measures installed and the desire to reduce energy costs were significantly and positively related to the NTGR. In addition, the NTGRs were lower for those customers who thought about installing the efficient equipment prior to hearing about the SPC Program. Also, while evidence suggests that the greater engineering sophistication of facility managers at large commercial and industrial sites also contributes to the low NTGR, regression models could detect only moderate size negative effect. Interestingly, whether one has developed a policy for energy efficiency, the type of customer (commercial, industrial, or other), and whether one applied as a self-sponsor or through an EESP has no significant impact on the NTGR.

- Logistic regression analysis found only a few good predictors of why customers choose to sponsor their own projects rather than selecting an EESP sponsor. The odds of applying through an EESP go up by a factor of more than 4 as more measures are installed. Of course, the causal direction is unknown (i.e., it might be that EESPs simply find more measures to install for their customers). If a customer's average monthly electric bill is high, the odds that they will apply through an EESP are approximately half of those of a customer whose electric bill is low. That is, small customers tend to apply through an EESP. Also, odds that customers in the commercial sector will participate via an EESP are 3 times those of non-commercial customers.

- While the effect of repeat participation in the SPC Program on NTGRs was explored, there were too few cases available for a reliable analysis.

Recommendations

- One should explore focusing more on medium-size commercial customers since we expect that their NTGRs will be larger (have the fewest freeriders). However, this should not be done to the exclusion of other industrial and commercial customers.

- The SPC Program should fine-tune the acceptance criteria for lighting projects since this type of project/measure has the highest freeridership.

E.4.2 Objective 2: Investigation of the Accuracy and Stability of the SPC NTGRs

Findings

- The NTGR is only moderately sensitive to the questions used to derive it, scale transformations, and weighting schemes. While this suggests that the NTGR is *stable*, it does not necessarily mean that it is an *unbiased* estimate.

- *Qualitative* analysis of additional questions related to customers' decision-making processes generally supported the *quantitative* estimates of the NTGRs. This means that the story surrounding customers' motives for installing the efficient equipment is internally consistent and that our quantitative estimate is, for the most part, reliable. Again, this is not to say that it is *unbiased*.

- Using historical data from 1994 through 1998 for all evaluations, we found no trends over time (1994 through 1997) in the NTGRs of each customer class (commercial, industrial, agricultural, and residential). There are no trends by end use, except for the NTGR for lighting, which is decreasing over time.

- NTGRs vary by SIC codes.

Recommendations

- We have only one recommendation regarding the questions and the algorithms used to estimate the NTGR and that is to explore a different set of weights to reflect the increased value of accelerating the installation of energy-efficiency projects. This could increase the NTGR by 4 to 5 percentage points.

- We do not recommend the combined use of both quantitative and qualitative data analyses to estimate NTGRs for all SPC participants. For most participants, the quantitative analysis alone appears to be sufficient.[1] However, such a combined approach would be worth performing for those participants with the largest savings since even small changes in their NTGRs can produce large impacts on the savings-weighted NTGR for the program.

- As noted earlier, lighting projects should be restricted because of their relatively low NTGRs.

- While it is interesting that NTGRs vary by SIC classification, it is unclear that these results are generalizable to the SPC Program, which is very different from the other non-residential programs that were implemented from 1994 through 1998 and may, as a result, have attracted a different mix of customers.

[1] We remind the reader that a *qualitative* analysis has always been and will continue to be routinely conducted in those cases where the answers to the battery of quantitative NTGR questions are inconsistent. In such cases, this qualitative analysis involves a review of customer responses to all relevant closed and open-ended questions regarding their decision to install the efficient equipment, in an attempt to resolve the inconsistencies.

E.4.3 Objective 3: Assessment of Bias in NTGR Estimation Techniques

Findings

- There appears to be a downward bias associated with using the self-report approach.

Recommendation

- We recommend negotiating a standard upward adjustment of NTGRs estimated using the self-report approach. We recommend a minimum upward adjustment of 0.10 to account for bias in the self-report technique.

E.4.4 Objective 4: Assessment of Recent Price Effects on NTGRs and TRCs

Findings

- Stakeholders are likely to continue to be concerned about cost-effectiveness.

- Whether an increase in price will reduce or increase the NTGR depends on the mix of customers and technologies that choose to join the SPC in an environment characterized by higher prices and lower reliability.

- Spillover has not been fully addressed in past evaluations or in the M&E protocols. While past evaluations of the SPC Program (1999, 2000, and 2001) have estimated the impact of spillover on the NTGRs, spillover adjustments to the SPC NTGRs have not been made. A conservative estimate of the spillover adjustment to the NTGR is 0.05.

- The TRC for the SPC Program is very insensitive to even dramatic reductions in the NTGR. This is not the case for other programs whose administrative costs are a greater fraction of the total program costs (administration and incentives), whose effective useful lives are shorter, or whose average per-unit savings are smaller.

- While environmental and transmission and distribution benefits have for some time been treated as benefits, on-peak escalators have only been recently been approved by the CPUC and can to some extent offset any decreases in NTGRs. A decision regarding off-peak escalators has yet to be made.

Recommendations

- Assess the return on investing additional evaluation dollars to measure spillover. If the return on such an investment seems reasonable, we recommend immediately expanding on the one page currently devoted to discussing spillover in Appendix J of the M&E protocols. This is necessary since pursuing more spillover that results in upward adjustments to NTGRs will invite more scrutiny from the CPUC. A good source upon which to base modifications to Appendix J is a report on methods for estimating spillover produced by Cambridge Systematics (1994).

- Explore the identification of other benefits, such as the economic benefits associated with the retention of jobs in California and health benefits, not currently included in the various cost-benefit tests.

- Given that it may require as much as several years for spillover to occur and be measured and that participants may become more uncertain (due to the turbulent environment created by deregulation) regarding the role of the SPC Program in their decision to install the efficient equipment, one should at least consider the short-term, *temporary* use of a default NTGR that incorporates an upward adjustment of 0.10 to account for the bias in the self-report approach and an additional 0.05 to account for spillover. Note that an additional increase could be obtained by assigning a different set of weights to reflect the increased value of accelerating the installation of energy-efficiency projects. During this period, the SPC evaluations could focus on verifying spillover, estimating gross impacts, conducting process evaluations, developing market characterizations and customer targeting, and estimating savings potential. Once the environment stabilizes, it is vital that utilities resume estimating net program impacts.

E.4.5 Further Research

While data from the evaluation of the 2000 and 2001 SPC Programs were not available for this analysis[3], we do not expect that the inclusion of these data into our analyses would substantially change the conclusions and recommendations contained in this report. However, in order to provide a more comprehensive analysis, it might be useful to incorporate these two program years into our analysis at a later date.

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[2] For example, if one starts with an NTGR of 0.53, adds 10 percentage points due to the bias of the self-report approach, adds another 5 percentage points for spillover, and adds another 2 percentage points to account for the fact that SPC lighting projects have been significantly reduced, one arrives at a NTGR of 0.70.

3 The NTGRs for the 2000 and 2001 SPC Programs are .41 and .65 respectively. For more details, see “2000 And 2001 Nonresidential Large SPC Evaluation Study: Final Report.” prepared for the Southern California Edison Company by XENERGY, 2001.

1 INTRODUCTION

1.1 BACKGROUND

1.1.1 SPC Program

Under the 1998 Nonresidential Standard Performance Contract (NSPC) Program and the 1999 Large Nonresidential Standard Performance Contract (LNSPC) Program (both hereafter referred to simply as the SPC Program), the program administrators (Pacific Gas & Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company) offered a fixed-price incentive to end users or third-party energy-efficiency service providers (EESPs) for measured kilowatt-hour (kWh) energy savings achieved by the installation of an energy-efficiency project. The fixed price per kWh saved, performance measurement protocols, payment terms, and all other operating rules of the program are specified in a standard contract. The role of the program administrator is to manage the program in a fair and nondiscriminatory manner, promote the program, educate customers and EESPs about the program, and enter into contracts with applicants to pay for measured energy savings.

The SPC Program is a “pay-for-performance” program. With traditional utility rebate programs, the utility pays an incentive directly to its customers based on an estimate of annual savings from a project. However, with the pay-for-performance SPC Program, the utility pays a variable incentive amount to a third-party EESP, or to a customer acting as their own EESP, based on measured energy savings. The SPC Program is also different from traditional utility rebate programs in that the total incentive is paid over an extended 2-year performance period. During the performance period, the EESP must measure and verify the energy savings actually achieved using a mutually agreed upon measurement protocol.

Because of the pay-for-performance nature of the SPC Program, a key requirement for project eligibility is that the savings resulting from the project must be measured in accordance with a project-specific measurement and verification (M&V) plan. The M&V plan must be prepared by the project sponsor in accordance with the Program Procedures Manual and must be mutually agreed upon by the program administrator and the EESP prior to beginning any work on project installation.

To qualify for the SPC Program, a project must produce a minimum level of kWh savings per year. Two or more projects may be combined, or “aggregated,” to meet this requirement. Aggregated projects must employ the same energy-efficiency measures and be installed at similar sites in order to make M&V of multiple projects feasible. The SPC Program is open to almost any equipment replacement or retrofit project for which the savings can be measured and verified. The project must have a useful life of greater than 3 years. Eligible energy-efficiency technologies, or “measures,” include, but are not limited to, replacement of standard fluorescent lighting with high-efficiency fluorescent lighting, installation of variable-speed drives on electric motors, installation of lighting controls to reduce lighting operating hours, and replacement of standard-efficiency air conditioning equipment with high-efficiency equipment. Projects that are not eligible include any power generation projects, co-generation, fuel substitution or fuel switching projects, new construction projects, and any repair or maintenance projects.

Both the 1998 and 1999 SPC Programs were evaluated using a method approved in the *Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs,* better known simply as M&E Protocols. Before discussing the specific method and the results, a brief overview of the M&E Protocols is provided, which will provide the context for understanding the origins of the method used for evaluating the 1998 and 1999 SPC Programs.

1.1.2 The M&E Protocols

Since PY 1994, California investor-owned utilities have been required to evaluate their demand-side management (DSM) programs. The guidelines for evaluating these programs are contained in the M&E Protocols, which focus on the critical elements of M&E such as load impact estimation models, sampling, and metering and are specific to various combinations of customer sectors, program types, and end uses. These standards are understood to be minimal and are in many cases quite general. For example, the protocols state that the load impact models for commercial retrofit programs may be some variant of allowable regression model types[1], or a calibrated engineering model, both possibly supplemented by an engineering simulation model. In addition, both participants and nonparticipants must be examined to estimate net program load impacts, and the sample sizes must be at least 350 for each group of nonresidential customers or 200 for each group of residential customers. It is important to note here that, unlike the other DSM programs, the M&E Protocols have never required a comparison group comprised of nonparticipants for the industrial audit and rebate programs in order to estimate net impacts or net-to-gross ratios (NTGRs). The M&E Protocols only require that "Each utility must conduct an assessment of the extent to which major measures that are being promoted in the IEEI (Industrial Energy Efficiency Incentive) Program may have been installed by some customers in the absence of a program" (p. C-9).

However, the protocols are for the most part silent regarding such detailed methodological issues as the actual specification of regression models, testing of statistical assumptions underlying regression models, and power analysis. Calibrated engineering models as well as engineering models also lack any methodological guidance. Thus, simply adhering to these minimal standards contained in the M&E Protocols is no guarantee that an analyst is doing a professionally respectable job. While one could simply ask analysts to guarantee that they adhered to the methodological guidelines contained in standard textbooks, this may not be sufficiently reassuring either to utility or regulatory staff. Thus, rather than simply trust analysts to follow the guidance contained in the basic methodological textbooks, the Quality Assurance

1 For a more detailed definition of the various model types currently under discussion, please see "An Evaluation of Statistical and Engineering Models for Estimating Gross Energy Impacts" by Ridge et al., 1994.

Guidelines (QAG) for Statistical and Engineering Methods for Estimating DSM Program Impacts were developed. The QAG is contained in Appendix J of the M&E Protocols.
In May of 1997, in order to provide methodological guidance in the industrial sector in which a comparison group is not required, the QAG was revised to include a discussion of methods for estimating NTGRs [2] based only on participant self reports, which was simply named the "self-report method." (Pages 47-59 of Appendix J address the self-report method and are contained in Appendix A.). The guidelines for the self-report method address a variety of issues including:

- Identifying the correct respondent
- Use of multiple measures
- Use of multiple respondents
- Measures of reliability
- Handling apparent inconsistencies
- Consistency checks
- Making the questions measure-specific
- Partial freeridership
- Deferred freeridership
- Assessing spillover
- Third-party influence
- Scoring algorithms
- Handling non-responses and "don't knows"
- The use of qualitative data and reporting requirements
- Data collection
- Establishing rules for data integration
- Analysis
- Weighting.

2The M&E Protocols define an NTGR as: "A factor representing net program load impacts divided by gross program load impacts that is applied to gross program load impacts to convert them into net program load impacts. " (p. A-10) A high NTGR suggests that a program is successful in motivating customers to invest in energy efficiency beyond what they would have done in the absence of the program. A lower NTGR suggests that fewer customers were motivated by the program to invest in efficiency. While the SPC Program is cost-effective despite its relatively low NTGRs, SCE is concerned because the low NTGRs suggest that the program is not as effective as it could be.

1.1.3 The 1998-1999 SPC Results

For the 1998, 1999, 2000, 2001 SPC Programs, it was decided to estimate NTGRs based on the self-report method. The NTGRs for the 1998 and 1999 SPC Programs resulting from the use of the self-report method are both 0.53. Thus, it appears that slightly less than half of the projects associated with these two programs are likely to have occurred in the absence of the program. The concern is that these low NTGRs reduce the available kWh and kW in the DSM portfolio, utility earnings, and the cost-benefit ratio for the SPC Program. While data from the evaluation of the 2000 and 2001 SPC Programs were not available for this analysis[3], we do not expect that the inclusion of these data into our analyses would substantially change the conclusions and recommendations contained in this report. However, in order to provide a more comprehensive analysis, it might be useful to incorporate these two program years into our analysis at a later date.

1.2 RESEARCH OBJECTIVES

General concern was expressed by California investor-owned utilities concerning the relatively low (relative to other industrial programs as well as other non-residential and residential programs) NTGRs estimated for the 1998 and 1999 SPC Programs. From this general concern, four major research objectives emerged:

1. To investigate why the SPC Program has such a relatively high rate of freeridership:
   - To assess how program features or targeting could be changed to reduce the rate of freeridership, and
   - To investigate which customer and project characteristics seem to be associated with high or low freeridership.
2. To investigate the accuracy and stability of the NTGRs estimated for the 1998 and 1999 SPC Program and assess which survey questions seem to be driving the freeridership result.
3. To determine whether the self-report approach to estimating NTGRs is systematically biased.
4. To assess the affect of the recent, dramatic increase in electricity prices on NTGRs and TRC.

The remainder of this report begins with a description of the various methods used to address these research objectives, followed by a presentation of the results. Finally, we present our conclusions and recommendations.

[3] The NTGRs for the 2000 and 2001 SPC Programs are .41 and .65 respectively. For more details, see "2000 And 2001 Nonresidential Large SPC Evaluation Study: Final Report." prepared for the Southern California Edison Company by XENERGY, 2001.

2 METHODS

In this section, for each of the four study's objectives, we describe the various methods employed.

2.1 OBJECTIVE 1: EXPLORATION OF THE REASONS FOR HIGH FREERIDERSHIP

We addressed the first research objective through a re-analysis of the 1998 and 1999 SPC data. The regression analysis of these data involved an examination of which variables might be associated with high freeridership (low NTGR) or low freeridership (high NTGR). Before beginning the analyses, we identified a set of questions that were common across both 1998 and 1999. We then modified a number of the variables to ensure consistent variable names and coding and pooled the 1998 and 1999 Program data into an application-level file. The final analysis file included such variables as the NTGR, average monthly electricity bill, square footage, presence of a policy regarding the purchase of energy efficient equipment, the type of SPC application (EESP or self-sponsor), at what point in their decision-making process did the customer become aware of the SPC Program, the number measures installed, and the end use affected.

A variety of regression models were specified. For each model, any necessary adjustments were made in light of regression diagnostics for collinearity, outliers, and heteroscedasticity. A variety of weights were also calculated for use in the analyses (see Appendix F). The general form of the models are provided below with the model statistics for the various estimated models provided in Appendix E.

$$\text{NTGR}_i = \alpha + \sum_{k=1}^{K} \beta_k X_{ik} + \varepsilon_i \qquad \textbf{Eqn. 2-1}$$

where

NTGR_i = NTGR for the i^{th} customer

α = the intercept

X_{ik} = a vector of customer characteristics for the i^{th} customer

β_k = a vector of k coefficients that reflect the NTGR change associated with a one-unit change in the k^{th} explanatory variable.

ε_i = captures the differences in NTGRs among the various customers that are not explained by the model.

Since the NTGR for EESP projects was much higher than the NTGR for self-sponsored projects, we also investigated why a customer chose to sponsor their own project or select an EESP to sponsor their project. Understanding this selection process could allow program planners to better market the program to customers who are more likely to seek out an EESP sponsor for their projects. The general form of the logit model is provided below with the model statistics for the various estimated models provided in Appendix E.

$$\Pr ob(EESP) = \frac{e^{\beta Z_i}}{1 + e^{\beta Z_i}} \qquad \textbf{Eqn. 2-2}$$

where

Prob(EESP) =	the probability of selecting an EESP sponsor
Z_i =	a vector of customer characteristics for the i^{th} customer
β =	a vector of estimated coefficients that maximizes Prob(EESP)

2.2 OBJECTIVE 2: INVESTIGATION OF THE ACCURACY AND STABILITY OF THE SPC NTGRS

The second objective involved four separate analyses: 1) a sensitivity analysis using the 1998 and 1999 SPC data, 2) a qualitative analysis of the 1998 and 1999 SPC data, 3), a meta-analysis of evaluation studies filed with the CPUC by California by investor-owned utilities between 1994 and 1998, and 4) an analysis of actual evaluation datasets for a subset of 16 studies filed with the CPUC by California by investor-owned utilities between 1994 and 1998.

2.2.1 Sensitivity Analysis

We conducted an analysis to determine how sensitive the NTGRs were to the inclusion of specific questions and linear and non-linear transformations of scales that measured, for example, the role of the incentives in their decision to install the efficient equipment. We also explored the use of various weighting schemes. For example, taking a simple average of three questions to form a NTGR assigns, in effect, an equal weight to each of the three questions. Assigning a different weight to each question reflects the possibility that the importance of each question to the NTGR actually varies. We created nine additional NTGRs that reflected these systematic modifications. Details of the construction of these nine NTGRs are provided in Appendix D.

2.2.2 Qualitative Analysis

There are three sub-objectives for this qualitative analysis: 1) to gain some insight into the reasons for very high or very low quantitative-based NTGRs, and 2) to assess the extent to which the quantitative NTGR and the NTGR implied by the qualitative data are consistent1, and 3) whether a qualitative analysis should be done for all cases, regardless of whether there are

1 A qualitative analysis of closed- and open-ended questions following a quantitative analysis of closed ended questions is referred to as a mixed methodology (Tashakkori and Teddlie 1998). In such a sequence, the qualitative analysis is used to confirm or disconfirm the NTGR derived from the quantitative analysis.

inconsistencies in the answers to the battery of NTGR questions. If they are inconsistent, we recommend an adjustment based on the preponderance of the quantitative *and* qualitative evidence. We then address the question as to whether case studies, involving the use of quantitative and qualitative data, should be routinely conducted for larger projects in order to provide a more comprehensive analysis leading to a more robust estimate of the NTGR.

We begin by noting that a *qualitative* analysis has always been routinely done in those cases where the answers to the battery of quantitative NTGR questions are inconsistent. The qualitative analysis involved a review of customer responses to various open-ended questions regarding their decision to install the efficient equipment. This qualitative analysis examines the answers to all the relevant open and close-ended questions in an attempt to resolve the inconsistency.

Ten 1999 SPC projects for which we have completed interviews were selected to receive a more in-depth analysis of all questions related to the NTGR. The cases investigated were randomly selected within each of the four NTGR strata, as indicated in Table 2-1. Table 2-2 presents basic information on the 10 cases that were investigated.

Table 2-1
NTGR Case Study Selection by Strata

NTGRs	# of Cases	# of Cases Investigated	% of Cases Investigated
.000-.250	13	3	23%
.251-.500	15	3	20%
.501-.750	6	1	17%
.751-1.00	13	3	23%
Totals	47	10	21%

2.2.3 Meta-Analysis

We also conducted a meta-analysis[2] of historical data from a much larger pool of completed evaluations. Such a historical analysis, can provide some useful insights into patterns that can only emerge when you have an analysis dataset large than 81, the size of the 1998 and 1999 SPC file for which we have NTGRs. Thus, a meta-analysis of those evaluation studies filed with the CPUC during the period 1994-1998 was conducted to determine whether there is a trend in the NTGR over time and whether the NTGR varied across end uses and time. For example, it might

[2] Meta-analysis can be understood as a form of survey analysis in which research reports, rather than people, are surveyed (Lipsey and Wilson 2001).

Table 2-2
Vital Statistics on NTGR Case Studies Selected

Case #	Business Type	Utility	Sponsor Type	Incentive Strata	NTGR
1	Institutional	PG&E	EESP	3	0.032
2	Industrial	SCE	Self	3	0.032
3	Industrial	PG&E	Self	3	0.240
4	Institutional	SCE	EESP	3	0.265
5	Commercial	SDG&E	EESP	3	0.315
6	Commercial	ALL	EESP	1	0.350
7	Institutional	SCE	EESP	2	0.667
8	Commercial	ALL	EESP	1	0.892
9	Commercial	ALL	EESP	2	0.892
10	Industrial	SCE	Self	3	0.917

also be the case that NTGRs vary by end use and that the NTGRs for a given end use might be declining over time. If one or more of the end uses that are heavily promoted by the SPC tend to have low NTGRs, then this suggest that perhaps the size of the rebate could be reduced or that the end use should be removed from the list of measures promoted by the Program. Or, if the NTGRs for industrial customers participating in other DSM programs is declining over time, then the low NTGR for the SPC Program might not be that unusual.

We began by obtaining 115 DSM evaluations filed by the California investor-owned utilities from 1994 through 1998. The NTGRs, gross kWh savings, therm savings, kW demand reductions, and end uses were then extracted and entered into an Excel spreadsheet. From these 115 DSM evaluations, a total of 192 observations were created since some studies dealt with a single end use for a given program (see Appendix C for a complete listing of these studies). We then converted these Excel files into a SAS database for analysis.

2.2.4 Analysis of Historical Evaluation Data

Finally, we also examined the actual evaluation SAS datasets for 16 Industrial Energy Efficiency Incentive Programs sponsored by PG&E (1995, 1996, 1997, 1998), SCE (1996 and 1997), and SDG&E (1995, 1996, and 1997). For SCE, we also examined the 1996 and 1997 DSM Bidding Programs. In our analysis, we focused on whether NTGRs varied by SIC codes 13 and 20-39. The results of this analysis could be used by program planners to better target the SPC Program in order to improve the NTGR.

2.3 OBJECTIVE 3: ASSESSMENT OF BIAS IN NTGR ESTIMATION TECHNIQUES

An examination of historical data covering a broader range of customer segments and estimation techniques can provide some very useful insights into the effects of customer type and estimation technique on the NTGR. A meta-analysis of those evaluation studies filed with the CPUC during the period 1994-1998 was conducted to address the third objective, i.e., whether the self-report method by its nature results in NTGRs that are systematically higher or lower than those produced by either discreet choice analysis or by regression analysis. 3 Note that we have much greater confidence in the NTGRs estimated using billing analysis and discreet choice analysis because of their use of comparison groups combined with sophisticated statistical analyses. The question is: How similar are the NTGRs using the self-report approach to those using these more advanced techniques?

The NTGRs, gross kWh savings, therm savings, kW demand reductions, end uses, and the primary estimation technique (the one upon which a utility's earning claim was based) were extracted from 115 DSM evaluations filed with the CPUC. A total of 192 observations were created since some studies dealt with multiple end uses (see Appendix C for a complete listing of these studies).

We continued our review of these past studies, focusing specifically on those studies that used *all three techniques* (regression analysis, discrete choice analysis, and the self-report approach) to estimate the NTGR for selected measures. If the self-report approach consistently produces higher or lower estimates of NTGRs, then one might suspect that this technique is systematically biased. We identified five studies that used all three techniques to estimate NTGRs, focusing primarily on the HVAC end use. The five studies are:

1. The evaluation of PG&E's 1991 Commercial, Industrial, and Agricultural Retrofit Incentives Program entailed four separate studies, each employing a different technique to estimate the net-to-gross ratio. The NTGRs presented are for HVAC. The three that are of particular interest to us are listed below:

    a. Commercial, Industrial, and Agricultural Retrofit Incentives Program Net-To-Gross Ratios for PG&E's CIA Rebate Program: Study A - Participant Survey, XENERGY, April 1992.

3 The M&E Protocols define discreet choice analysis as a statistical model that does not use energy consumption as the dependent variable but rather uses the observed decisions of customers to participate in DSM programs and to install efficient equipment as the dependent variables. The purpose of these models is to derive a net-to-gross savings adjustment that is applied to estimates of gross impacts to derive net impacts (p A-5). The M&E Protocols defines a regression analysis as an econometric or statistical model that employs billing data as the dependent variable with weather data and specific customer attributes as the independent variables. Non-participants are included with participants in the model to derive net kWh impacts.

   b. Commercial, Industrial, and Agricultural Retrofit Incentives Program Net-To-Gross Ratios for PG&E's CIA Rebate Program: Study D - Decision Analysis Model, XENERGY, September 1993.

   c. Commercial, Industrial, and Agricultural Retrofit Incentives Program Net-To-Gross Ratios for PG&E's CIA Rebate Program: Study C - Treatment/Control Comparison, XENERGY, September 1993.

2. The evaluation of PG&E's 1994 Commercial HVAC Program involved the used all three techniques in estimating the net-to-gross ratio,1994 Commercial HVAC Impact Evaluation, prepared by SBW Consulting, Ridge & Associates, KVD Research Consulting.

3. 1996 PG&E Commercial Energy Efficiency Incentive Program: HVAC Technology (Study ID: 351), prepared by Quantum Consulting, March 1998.

4. 1997 PG&E Commercial Energy Efficiency Incentive Program: HVAC Technology (Study ID: 333B), prepared by Quantum Consulting, March 1999.

5. 1997 PG&E Commercial Energy Efficiency Incentive Program: Lighting Technology (Study ID: 338A), prepared by Quantum Consulting, March 1999.

Before using any of these studies, we first verified that all three techniques used in each of these studies are consistent with the guidelines contained in the M&E Protocols.

2.4 OBJECTIVE 4: ASSESSMENT OF PRICE EFFECT ON NTGRS AND TRCS AND POSSIBLE RESPONSES

In the face of recent and dramatic increases in the price of electricity, the impact on the NTGR and the TRC could be equally dramatic. Depending on the mix of customers who are attracted to DSM programs, the rate of freeridership may increase or decrease, which affects not only the available kWh and kW in the DSM portfolio and utility earnings, but also the various benefit-cost tests.

As the price of electricity increases, it may mean that the payback for investing in energy efficient equipment decreases thus increasing the chances that customers who participate in the DSM programs would probably have invested in the efficient equipment on their own. This would produce a higher rate of freeridership and lower NTGRs. In a resource acquisition framework, low NTGRs simply reduce the supply of savings or negawatts. Low NTGRs also reduce utility earnings and threaten the cost-effectiveness of the DSM program by reducing their net benefits.

It is also possible that the level of freeridership could decrease. For example, customers who have previously not participated in the DSM programs may now, because of high electricity prices, be motivated to join a DSM program. However, these customers may not have adequate cash to invest in efficiency measures even in the face of higher electricity prices and shorter paybacks. However, with the assistance of rebates and other assistance provided the DSM programs, they would be induced to make such investments.

One way to address a decreasing NTGR is through the identification of spillover. The M&E Protocols define spillover as:

> Reductions in energy consumption and/or demand in a utility's service area caused by the presence of the DSM program, beyond program-related gross savings of participants. These effects could result from: (a) additional energy efficiency actions that program participants take outside the program as a result of having participated; (b) changes in the array of energy-using equipment that manufacturers, dealers, and contractors offer all customers as a result of program availability; and (c) changes in the energy use of non-participants as a result of utility programs, whether direct (e.g., utility program advertising) or indirect (e.g., stocking practices such as (b) above, or changes in consumer buying habits) (p. A-9).

To address the issue of spillover, we continued our examination of 125 studies filed by PG&E and SCE from 1994 through 1998, focusing on three questions:

1. What percent of these studies attempted to measure spillover?

2. For those studies in which spillover was measured, what percent incorporated spillover into the final NTGR?

With respect to the benefit-cost issue, there are a variety of benefits that could be identified and incorporated. These benefits include reductions in air emissions and increased reliability of the supply of electricity, which has a number of economic benefits including California business retention. We examined the extent to which these are taken into account in cost-effectiveness tests and recommend future action.

3 RESULTS

The results are organized by the four major research objectives in this section of the study.

3.1 OBJECTIVE 1: EXPLORATION OF THE REASONS FOR HIGH FREERIDERSHIP

Objective 1 addressed the question as to why the SPC Program has such a relatively high rate of freeridership (or a low NTGR). In this analysis, we attempt:

1. To assess how program features or targeting could be changed to reduce the rate of freeridership
2. To investigate which customer and project characteristics seem to be associated with high or low freeridership.

3.1.1 Descriptive Statistics

We begin with some basic descriptive statistics regarding the sample of 1998 and 1999 SPC Program participants upon which our analyses are based. In 1998 and 1999, the sample of participants installed 1,027 measures within 5 end uses. Table 3-1 presents the frequency for each end use. As one can see, lighting accounted for over 58 percent of the all the measures installed, followed by HVAC with 22 percent of the measures.

Table 3-1
PY 1998 and PY 1999 End Uses

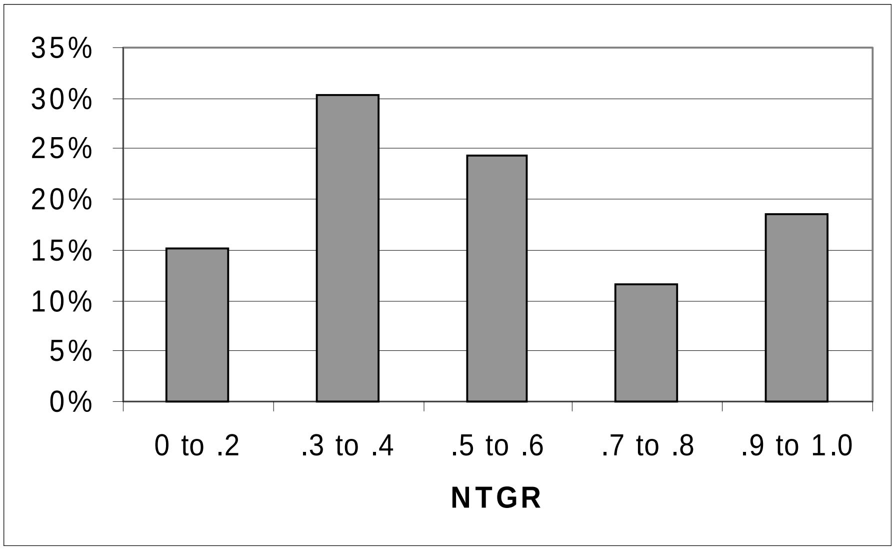
End Use	Frequency	Percent
HVAC	225	22
Lighting	597	58
Motors	96	9
Process	63	6
Refrigeration	46	4
Total	1027	100

First, the distribution of the NTGRs for PY 1998 and PY 1999 participants is approximately normal with an unweighted mean of 0.488 and a coefficient of variation (standard deviation divided by the mean) of 0.57. Figure 3-1 displays the distribution.

To get a feel for the data, it is useful to examine the two-variable (bivariate) relationships before proceeding to multivariate relationships. Whether these bivariate relationships hold up in a multiple regression framework will be addressed later in this report.

The first observation is that the NTGR varied depending on whether a customer was a self-sponsor or whether an EESP sponsored their project. When the 2 years were combined, the EESP-sponsored projects have an average NTGR of 0.57, which is significantly larger than the average NTGR of 0.40 for self-sponsored projects ($t=2.11$, $p > |t| = .04$). This finding is partly explained by the fact that customers who choose to sponsor their own projects tend to be larger than those who select an EESP sponsor both in terms of square footage (46 percent larger) and annual monthly electricity bills (7 percent higher). Larger customers, it has been argued, tend to be more sophisticated than smaller customers regarding energy issues, making larger customers more likely to have installed the efficient equipment on their own.

Figure 3-1
Distribution of Reported NTGRs for PY 1998 and PY 1999 SPC Program



In addition, whether a customer was defined as an institutional customer (school or hospital), a government customer, an industrial customer, a commercial customer, or in the "other" category appears to make some difference. Table 3-2 presents the mean NTGRs and the number of observations for each of these five sectors.

Table 3-2
Mean NTGRs, by Sector

Sector	Mean NTGR	Number of Observations
Commercial	0.59	23
Other	0.48	7
Industrial	0.44	20
Institutional	0.40	19
Government	0.39	10

The commercial sector has the highest mean NTGR by far. However, there is no statistically significant difference between the commercial mean NTGR and the mean NTGRs of any of the other sectors. This is primarily due to the small number of cases available for this analysis. A larger number of observations would clearly allow some of these differences to emerge as statistically significant. For example, the difference between the commercial mean NTGR of 0.59 and the government mean NTGR of 0.39 would be statistically significant if the number of observations in each group were larger, thus increasing the statistical power of the tests. Despite the lack of statistical significance, some of the larger differences are of practical significance. NTGRs also varied by end use. Table 3-3 presents these results.

Table 3-3
NTGRs by End Use

End Use	NTGR
Refrigeration	0.74
HVAC	0.62
Process	0.57
Motors	0.49
Lighting	0.40

That lighting accounts for 58 percent of the measures and has the lowest NTGR at least partly explains the low NTGR. These results suggest that removing lighting measures from the list of eligible measures would probably increase the NTGRs for future SPC Programs.

Another observation is that customers who apply via an EESP install, on average, 21 measures while those who self-sponsor install 11 measures. These two means are not statistically different ($p > |t| = 0.15$). However, a larger sample would very likely allow a difference of this size to emerge as statistically significant. The causal direction is, however, difficult to determine. That is, do customers with multiple measures seek out EESPs or do EESPs, once selected by a customer, tend to identify multiple opportunities for savings?

It is also worth noting that there is a clear relationship between the type of customer (commercial, industrial, and other) and whether a customer decides to be a self-sponsor or an EESP-sponsor. Table 3-4 presents these results, which suggest that commercial customers are much more likely to participate via an EESP. However, the relationship is only moderate.[1]

[1] The uncertainty coefficient is 0.10. This means that 10 percent of the uncertainty regarding whether a customer will select an EESP or choose to be a self-sponsor is explained by a customer's sector (commercial, industrial, or other).

Table 3-4
Type of Customer, by EESP Vs. Self-Sponsor

Sector	EESP		Self-Sponsor		Total
	n	%	n	%	
Industrial	9	45	11	55	20
Commercial	20	87	3	13	23
Other	19	53	17	47	36
Total	48		31		79
Chi-Square=9.67, p=0.01					

A final observation is that there does not appear to be any relationship between the NTGR and whether a customer participated in both the 1998 and 1999 SPC Program. Only four customers in our sample participated in both program years. Table 3-5 presents the NTGRs for each of the four in both years.

Table 3-5
NTGRs for Repeat Participants

Project	1998 NTGR	1999 NTGR	Delta
Project #1	0.47	0.24	0.23
Project #2	0.60	1.00	-0.40
Project #3	0.00	0.28	-0.28
Project #4	0.49	0.16	0.33
Average	0.39	0.42	-0.03

Of the four customers, two experienced an increase in their NTGRs while two experienced a decrease, with an increase in the overall average NTGR of 3 percentage points. Based on this very small sample, there does not appear to be any relationship. However, this question should be addressed more fully through an analysis of much larger historical databases.

One could argue that these simple observations could motivate three changes for program eligibility:

1. Fine-tune the acceptance criteria for lighting projects, since this type of project/measure has the highest freeridership
2. Targeting commercial customers
3. Targeting medium-size customers.

For a variety of reasons, SPC Program planners have already decided to route nearly all lighting projects through the Express Efficiency Program. The reduction of lighting projects should result in an increase in the NTGR. In addition, emphasizing medium-size commercial customers should raise the NTGR since they are less likely to have the expertise within their own organizations to identify and install cost-effective, energy-efficient technologies. Such customers tend to rely more on the services and financial incentives provided by EESPs, which increase the NTGR.

3.1.2 Regression Analysis

A multiple regression analysis was conducted to determine if we could explain variation in the NTGRs as a function of customer characteristics. In Table 3-6, we present the results for one of the better models.

The key features of this model, which explains 28 percent of the variation in the NTGR, are:

1. As the number of measures that were installed increases the NTGR increases.
2. This suggests that customers who have not installed energy-efficient measures to date have many savings opportunities have higher NTGRs but have chosen, for whatever reasons, not to make the installations on their own. The SPC Program may have induced them to make the installations.
3. The larger the size of the average electric monthly bill, the smaller the NTGR. While only approaching statistical significance, this suggests that bigger customers tend to have lower NTGRs. This is consistent with the belief that larger customers are more knowledgeable and sophisticated regarding energy efficiency and thus more likely to install the efficient equipment in the absence of the program. A recent study (PG&E 2000) found that, as we would predict, smaller customers participating in the Small Business SPC Program have a much larger NTGR of 0.62.
4. The greater the motivation to reduce one’s energy bill, the greater the NTGR. Those customers who are more alarmed by the size of their electricity bills may be alarmed because they have less cash. Because they have less cash to invest in efficient equipment, the financial assistance may be more important to them.
5. If customers learned about the program after they began to think about installing the efficient equipment, the lower the NTGR. This is intuitively appealing since customers who have already begin to think about a solution prior to hearing about the program are more likely to install the equipment on their own.

Interestingly, whether one has developed a policy for energy efficiency, the type of customer (commercial, industrial, or other), and whether one applied as a self-sponsor or through an EESP has no significant impact on the NTGR.

We note that in this model, with only 66 available observations, it was difficult for many variables to have an opportunity to emerge as statistically significant. In addition, measurement error no doubt played an important part in all estimated models. Measurement error affected both square footage and average monthly bill, which were both self-reported by the customer. We suspect that the errors are random, thus reducing the magnitude of the coefficients (Thompson 1996).

Table 3-6
Regression Model Results

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	0.68225	0.13800	4.94	<0.0001
Number of measures installed	0.13161	0.06182	2.13	0.0372
Average monthly electric bill	-0.03876	0.02725	-1.42	0.1600
Installed equipment to reduce energy costs	0.16768	0.05686	2.95	0.0045
Learned about program before thinking about installing	-0.20937	0.05710	-3.67	0.0005

Furthermore, the only significant variable that can be directly observed prior to participation is average monthly electricity consumption. This suggests that the focus should shift to somewhat medium-size customers who tend to use the services of EESPs and whose NTGRs would be somewhat higher than larger customers. Recall that a recent study (PG&Ei 2000) found that, as we would predict, smaller customers participating in the Small Business SPC Program have a much larger NTGR of 0.62. The details of other model results are presented in Appendix E. Note that the signs, magnitude, and statistical significance of the coefficients for the statistically significant or nearly significant variables in Table 3-6 are reasonably consistent across the various specifications presented in Appendix E.

We also estimated logistic regression models to explain whether one applied as a self-sponsor or via an EESP. In Table 3-7, we present the results for one of the more promising models. This model has two statistically significant variables: the number of measures installed and the average monthly electric bill. The odds of applying through an EESP go up by a factor of 4 as more measures are installed.[2] Of course, the causal direction is unknown (i.e., it might be that EESPs simply find more measures to install for their customers). In addition, if your average monthly electric bill is high, the odds of applying through an EESP are only about half as likely as those who electric bills are low. That is, large customers tend to be self-sponsors who, as

[2] The odds are calculated by exponentiating the coefficient. For example, exponentiating the coefficient of Number of Measures Installed in Table 1-9 (exp(1.4145)) yields 4.11.

noted earlier, tend to have lower NTGRs. This makes sense since large customers may already possess the skills and knowledge in house to recognize and pursue an investment in energy-efficient equipment even in the absence of the program. A third variable, whether a customer was in the commercial sector, was moderately significant (p = 0.09). The odds that a commercial customer applies through an EESP are about three times those of non-commercial customers.

Table 3-7
Logistic Regression Results

Variable	Estimate	Standard Error	Chi-Square	Pr > Chi-Square
Intercept	-0.6515	1.2642	0.2656	0.61
Commercial customer	1.117	0.6586	2.8764	0.09
Average monthly electric bill	-0.6572	0.2807	5.4801	0.02
Multiple locations	0.5877	0.5331	1.2156	0.27
Number of measures installed	1.4145	0.603	5.5028	0.02

The details of other model results are presented in Appendix E. Note again that the signs, magnitude, and statistical significance of the coefficients for statistically significant variables in Table 3-7 are reasonably consistent across the various specifications presented in Appendix E.

3.2 Objective 2: Investigation of the Accuracy and Stability of the SPC NTGRs

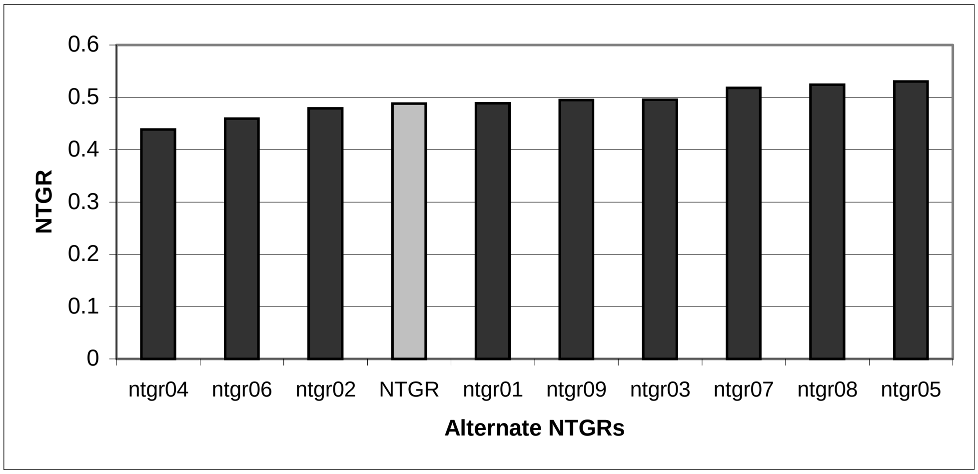
3.2.1 Sensitivity Analysis

The distribution of the nine NTGRs calculated is provided in Figure 3-2.[3] The gray bar represents the average of the NTGRs filed for the 1998 and 1999 SPC Programs. As one can see, there was some moderate sensitivity to the various algorithms, transformations, and weighting schemes. These NTGRs ranged from 0.44 to 0.53 with filed NTGR at 0.488. Such moderate stability provides some assurance that the questions used to calculate the reported NTGR did not produce extreme values and all the conceivable questions, transformations, and weighting schemes all point in more or less the same direction.

The highest NTGR (NTGR05) assigns greater weight to responses at the low end of the response continuum for Q. PD7a (see page D-7 in Appendix D). The second highest NTGR (NTGR08) assigns greater weights to responses to Qs. PD8b and PD9b (see page D-7 in Appendix D) that indicate that the SPC Program caused a greater acceleration of the project. This was done to reflect the fact that, in the current environment, savings that are achieved earlier than they would have in the absence of the program are particularly valuable.

[3] The calculation of these NTGRs is described in Appendix D.

Figure 3-2
Distribution of Nine NTGRs Calculated in Sensitivity Analysis



3.2.2 Qualitative Analysis of 1998-1999 SPC Data

All closed- and open-ended questions related to the decision to install the efficient equipment were reviewed with two objectives: to gain some insight into the reasons for very high or very low NTGRs and to assess the extent to which the quantitative NTGR and the NTGR implied by the quantitative *and* qualitative data are consistent. The information from the answers to these questions was integrated into an internally consistent story surrounding each participant's decision to install the efficient equipment. For each story, we assessed the extent to the NTGR implied by the story was reasonably consistent with the quantitative NTGR. If the story was inconsistent, we recommended an adjustment to the quantitative NTGR. The complete stories are presented in Appendix B. Table 3-8 summarizes these results.

In 5 out the 10 cases, we disagreed with the NTGR produced using only quantitative data. However, we hasten to add that in four of these five cases, the adjustment is either a very slight increase or a very slight decrease. In only one case, do we see any grounds for even a moderate change. In general, we concluded that published quantitative NTGR and information gained by examining the answers to larger set of qualitative questions are reasonably consistent. This consistency increases our confidence in the published NTGR. However, this does not suggest that a NTGR based only on the standard set of quantitative questions is sufficient. This is only one study, while several past studies (SCE 1998; SCE 1999; SCE 2000) have indicated that there is some benefit to conducting both a quantitative and qualitative analysis of those customers with the largest energy and demand reductions.

Table 3-8
Results of Qualitative Analyses

Case #	Business Type	Utility	Sponsor Type	Incentive Strata	NTGR	Agree-ment?	Adjustment
1	Institutional	PG&E	EESP	3	0.032	N	Down – Slightly
2	Industrial	SCE	Self	3	0.032	N	Down – Slightly
3	Industrial	PG&E	Self	3	0.240	Y	
4	Institutional	SCE	EESP	3	0.265	N	Down – Slightly
5	Commercial	SDG&E	EESP	3	0.315	Y	
6	Commercial	ALL	EESP	1	0.350	N	Up – Moderately
7	Institutional	SCE	EESP	2	0.667	Y	
8	Commercial	ALL	EESP	1	0.892	Y	
9	Commercial	ALL	EESP	2	0.892	N	Up – Slightly
10	Industrial	SCE	Self	3	0.917	Y	

This finding does not mean, however, that the published NTGR is *not* biased since the same bias could also affect the answers to the other questions related to the decision to install the efficient equipment. The next section attempts to determine whether there is a bias associated with any of the three estimation techniques.

3.2.3 Meta-Analysis

Recall that the data used for this analysis are drawn from the 115 evaluations filed in California by investor-owned utilities from 1994 to 1998. One factor that might at least partially affect the NTGRs in the SPC Program is that the NTGRs for the commercial and industrial sectors in general might be decreasing over time. From Figure 3-3, we can see that there is no trend in the savings-weighted NTGRs for any of the customer segments. However, the NTGRs for the industrial sector are the lowest in 2 of the 4 years and the second to the lowest in the other 2 years. The mean NTGRs by program, by customer segment are presented in Table 3-9. It is critical to note that, beginning with the PY 1994 programs, the evaluation of the industrial programs in California have always used the self-report approach, which appears, as we noted earlier, to have a systematic downward bias. How much of this difference is due to the method or due to the fact that industrial customers are more technically sophisticated regarding energy use and energy efficiency cannot be accurately determined.

Figure 3-3
NTGRs, by Customer Segment, by Year

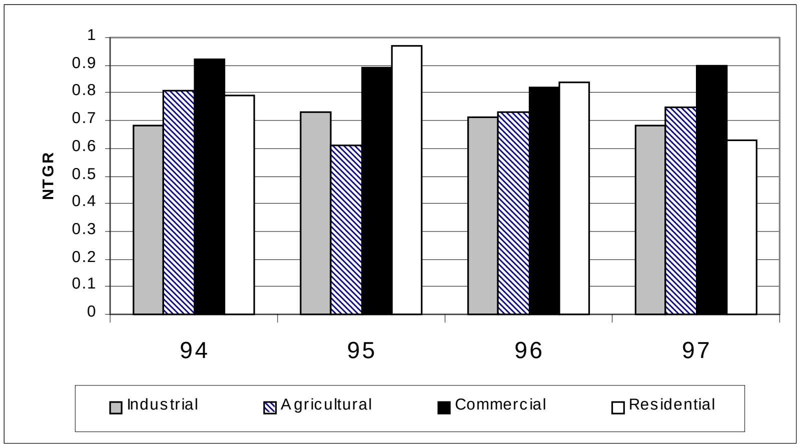


Table 3-9
Mean NTGRs by Customer Segment, by Program Year

Customer Segment	94	95	96	97	Average
Commercial	0.92	0.89	0.82	0.9	0.88
Residential	0.79	0.97	0.84	0.63	0.81
Agricultural	0.81	0.61	0.73	0.75	0.73
Industrial	0.68	0.73	0.71	0.68	0.70

From these 115 studies, we focused on 50 studies that addressed programs targeted for commercial and industrial customers. We calculated a savings-weighted average NTGRs for these 50 industrial and commercial studies by end use. Table 3-10 presents these NTGRs.

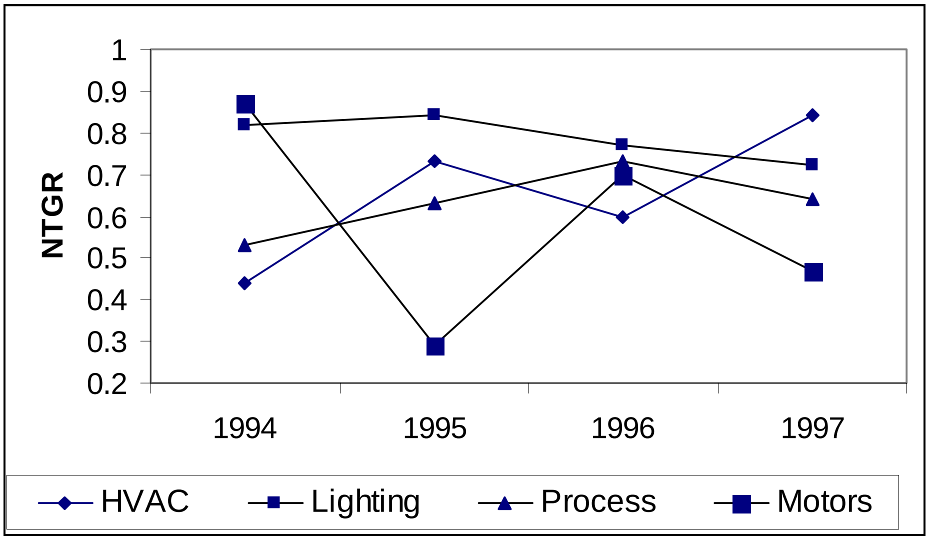
Table 3-10
NTGRs by End Use for the Commercial and Industrial Sectors

End Use	NTGR	Number of Studies
Lighting	0.81	15
Motors	0.76	5
Miscellaneous	0.75	5
Process	0.60	15
HVAC	0.58	10

The HVAC end use has the lowest NTGR at 0.58, followed by the process end use with a NTGR of 0.60. Lighting has the highest NTGR at 0.81. Note that Table 3-3, which displayed results of NTGRs by end use for the 1998 and 1999 SPC Program participants, lighting had the lowest NTGR. This difference is very likely due to the fact that the SPC Program focuses on large customers who are already aware of efficient lighting and its very favorable economics.

However, because these are average NTGRs across time, any trends are concealed. For example while the NTGR for the lighting measure is the highest at 0.81, the NTGR may be decreasing over time. Figure 3-4 presents the NTGRs from 1994 through 1997 for the commercial and industrial sectors by end use.

Figure 3-4
NTGRs for Commercial and Industrial Sectors Over Time, by End Use



From this figure, we can see that there is no trend for any of the end uses except for lighting, with a NTGR of 0.82 in 1994 and a NTGR of 0.72 in 1997. However, in 1997, the NTGR for lighting is still higher than both process and motors and not the lowest as in the case of the SPC Program. If data were available for 1998 and 1999, we could then observe whether the trend continued downward. A continuing downward trend would tend to support the argument that commercial and industrial customers are becoming more familiar with the favorable economics associated with lighting measures and tend more and more to install efficient lighting measures on their own. Even if the NTGR trend for lighting continued downward, it is not likely that it would reach 0.40 by 1999. It is very likely that any remaining difference in the lighting NTGRs is because the larger commercial and industrial customers tend to participate in the SPC Program. Such customers are even more aware of efficient lighting and its very favorable economics. This conclusion is supported by a recent market effects study of commercial lighting (PG&Eh and SDG&E, 1998), which found higher levels of market transformation for larger customers.

3.2.4 Analysis of Historical Evaluation Data

We also examined the actual evaluation SAS datasets for 16 industrial energy-efficiency incentive programs sponsored by PG&E (1995, 1996, 1997, 1998), SCE (1996 and 1997), and SDG&E (1995, 1996, and 1997). For SCE, we also examined the 1996 and 1997 DSM bidding programs. In our analysis, we focused on NTGRs, by SIC codes 13 and 20-39. These data allowed us to determine NTGRs by SIC code. Table 3-11 presents these results.

From this table, one can see that SIC 36, "Electronic and other electrical equipment and components, except computer equipment," has a relatively high NTGR of 0.76 and has a large number of participants (N=262). On the other hand, SIC 24, "Lumber and wood products, except furniture," has a relatively low NTGR of 0.41 and a relatively large number of participants (N=83). Based on these results, one could target those SIC codes with greater participation and higher NTGRs on the basis that this is a more effective strategy to acquire net kWh per dollar spent. For example, one could focus on SICs 35, 36, and 38 since they have high rates of participation and NTGRs ranging from 0.72 to 0.77, and one would pay less attention to SIC 24.

3.3 OBJECTIVE 3: ASSESSMENT OF BIAS IN NTGR ESTIMATION TECHNIQUES

Recall that this objective involved the a meta-analysis of data from 115 evaluation reports, broken down by end use, filed by California investor-owned utilities with the CPUC from 1994 through 1998. Note that while some utilities often estimated the NTGR, for a given program and end use, using more than two and sometimes three techniques, each utility had to designate the NTGR that should be the "official" one, i.e., the one upon which a utility's earnings claim would be based. This analysis focuses first on the official NTGRs. Table 3-12 presents the average NTGRs from the 115 studies by estimation technique and end use.

As one can see, the self-report approach has the lowest average NTGR at 0.71, with regression and discrete choice approaches yielding average NTGRs that are 11 percent points higher. Some of this difference can be explained by the fact that, in California, the self-report approach has been primarily used for industrial energy-efficiency incentive (IEEI) programs, in which large customers are typically over-represented among the participants. There is evidence that such customers tend to have facility or plant managers who are experienced engineers and who are familiar with the savings and the costs associated with the installation of energy-efficient equipment. Thus, they might be better able to identify cost-effective technologies and, for good economic reasons, have a greater tendency to install them on their own, even in the absence of DSM programs. This, of course, would manifest itself in lower NTGRs.

Table 3-11
NTGRs, by SIC Code

SIC Code	SIC Description	Mean NTGR	N
23	Apparel and other finished products made from fabrics and similar materials	1.00	8
31	Leather and leather products	0.99	6
26	Paper and allied products	0.90	88
29	Petroleum refining and related industries	0.85	52
39	Miscellaneous manufacturing industries	0.81	31
38	Measuring, analyzing, and controlling instruments; photographic, medical and optical goods, watches and clocks	0.77	125
36	Electronic and other electrical equipment and components, except computer equipment	0.76	264
35	Industrial and commercial machinery and computer equipment	0.72	263
28	Chemical and allied products	0.71	89
34	Fabricated metal products, except machinery and transportation equipment	0.70	119
37	Transportation equipment	0.69	147
13	Oil and gas extraction	0.68	53
25	Furniture and fixtures	0.66	18
33	Primary metal industries	0.65	69
20	Food and kindred products	0.63	228
32	Stone, clay, glass, and concrete products	0.63	73
30	Rubber and miscellaneous plastics products	0.62	120
22	Textile mill products	0.54	14
27	Printing, publishing and allied industries	0.54	169
24	Lumber and wood products, except furniture	0.41	83

Table 3-12
NTGRs, by Estimation Technique and End Use, for the Period 1994-1998

	Enduse							
Technique	**HVAC**	**Lighting**	**Motors**	**Process**	**Pumping**	**Refrigeration**	**Misc.**	**Overall**
Discrete Choice	0.71	0.89		1.00	0.68	0.80		0.82
Regression	0.83	0.81	0.58	0.80		1.06	0.82	0.82
Self-Report	0.71	0.78	0.64	0.68	0.67	0.74	0.77	0.71

On the other hand, it is also possible that these large customers have been frequently contacted year after year by utility staff responsible for implementing those DSM programs that were specifically targeted at the largest industrial and commercial customers. Such repeated exposure may have over time educated key decision makers regarding the economic benefits of installing energy-efficient equipment. However, if they participate in future programs, they may appear as freeriders in subsequent evaluations. To the extent that customers tend to participate in multiple years, they may manifest lower NTGRs. However, the results presented in Table 3-5 are based on too small a sample to fully address this question. An analysis of a larger sample of historical data should be undertaken to answer this question.

The problem with this approach is that there is a fair amount of noise in these data, stemming from differences in the mix of measures within an end use, mix of customers, and the size of any incentives that could cloud the relationship between the estimation techniques and NTGRs. In addition, these studies were conducted in different years with different prevailing economic conditions (e.g., interest rates and unemployment rates).

Next, we examined those five studies that used *all three* techniques for selected end uses. The review of the five studies that applied all three techniques to selected measures allowed us to control, within each study, for the mix of customers, measures, prevailing economic condition, consulting firms, and size of the incentives. *Note that we have much greater confidence in the NTGRs estimated using billing analysis and discreet-choice analysis because of their use of comparison groups combined with sophisticated statistical analyses*. How similar are the NTGRs using the self-report approach to those using these more advanced techniques? Table 3-13 presents these results.

Table 3-13
NTGRs Using Billing Analysis, Discreet Choice Analysis, and Self-Report for the HVAC End Use

Technique	NTGR[4]	NTGR[5]	NTGR[6]	NTGR[7]	NTGR[8]	Average
Billing Analysis	0.75	0.70	0.76	0.91	0.87	0.80
Discreet Choice	0.73	0.55	0.62	0.73	0.76	0.71
Self-report	0.31	0.57	0.44	0.32	0.74	0.51

Once again, we see that is a similar pattern with self-report NTGRs being much lower than the NTGRs for the other two techniques.

3.4 Objective 4: Assessment of Price Effect on NTGRs and TRCs and Possible Responses

3.4.1 Background

California in general and the utilities in particular are faced with a turbulent environment in which all the key elements that affect DSM programs are in flux. The basic model of this constellation of factors is captured in Figure 3-5, which shows that the NTGR is affected by at least five factors:

1. The basic approach (e.g., regression, discrete choice, self-report)
2. The implementation of the program in the field (e.g., whether program rules are enforced such as to minimize freeridership)
3. The amount of spillover identified
4. The scoring algorithms (i.e., which specific questions are combined and weighted to produce the NTGR)
5. The mix of participants and technologies.

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4 PG&E 1991 Commercial, Industrial, and Agricultural Retrofit Incentives Program: Studies A, C, and D, prepared by XENERGY, 1992-1993.

5 PG&E 1994 Commercial HVAC Impact Evaluation. Prepared by SBW Consulting, Ridge & Associates, KVD Research Consulting, March 1996.

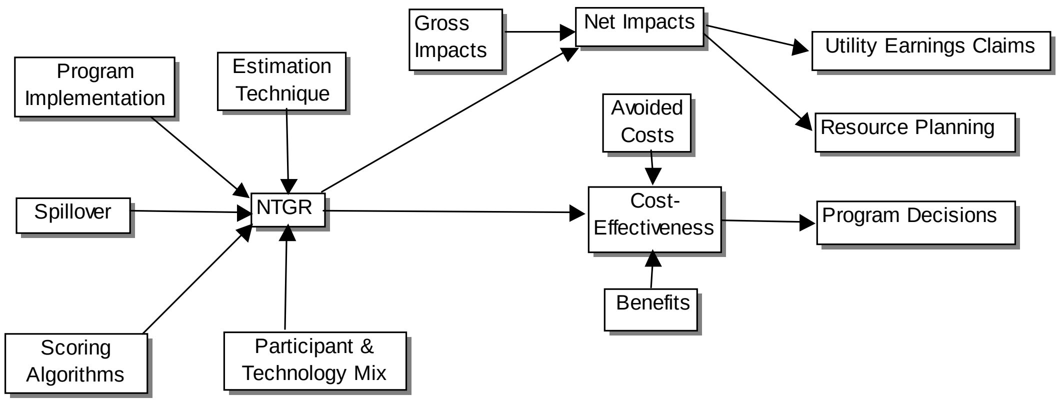
6 PG&E 1996 Commercial Energy Efficiency Incentive Program: HVAC Technology (Study ID: 351). Prepared by Quantum Consulting, March 1998. Note that the results reported in Table 2 are for central air conditioners.

7 PG&E 1997 Commercial Energy Efficiency Incentive Program: HVAC Technology (Study ID: 333B). Prepared by Quantum Consulting, March 1999. Note that the results reported in Table 2 are for central air conditioners.

8 PG&E 1997 Commercial Energy Efficiency Incentive Program: Lighting Technology (Study ID: 338A). Prepared by Quantum Consulting, March 1999. Note that the results reported in Table 2 are for a variety of lighting measures.

The NTGR is then applied to gross program impacts to produce net program impacts, which serve as the basis for utility earning claims and resource planning. Finally, the NTGR also affects the cost-benefit ratio that may support decisions to expand, reduce, or even terminate a program. This section attempts to touch on at least some of these factors.

Figure 3-5
Factors Affecting Earnings Claims, Resource Planning, and Program Decisions



3.4.2 Changes in NTGRs

Depending on the mix of customers who are attracted to DSM programs, the rate of freeridership and the NTGR (1-freeridership) may increase or decrease. As the price of electricity increases, it may mean that the payback for investing in energy-efficient equipment decreases, thus increasing the chances that customers who participate in the DSM programs would probably have invested in the efficient equipment on their own. This would produce a higher rate of freeridership leading to lower NTGRs. In a utility earnings and resource acquisition framework, low NTGRs simply reduce the supply of savings or megawatts. Low NTGRs may also threaten the cost-effectiveness of the DSM program by reducing their net benefits.

It is also possible that the level of freeridership could decrease. For example, customers who have previously not participated in the DSM programs may now, because of high electricity prices, be motivated to join a DSM program. If these customers do not have adequate cash flow or discretionary income, because of the high electricity prices, to invest in efficiency measures, even in the face of very low paybacks, the rebates could play a significant role in their decision to invest in energy efficiency, leading to higher NTGRs.

With this as background, we now attempt to answer two questions:

1. How could utilities and the state respond in the event that NTGRs decrease?

2. What is the context within which we explore the answers to this question?

We begin addressing the second question first. First, social science research methods (e.g., statistics, questionnaire design, sample design, experimental and quasi-experimental designs, etc.) designed to tease out the net effects of any program are well established and continue to evolve. The M&E Protocols, created to guide the evaluations of DSM programs in California, are consistent with these methods and also continue to evolve. In the current regulatory environment, it would be difficult to abandon or significantly modify these protocols. To do so might seriously reduce the confidence of key stakeholders in the estimates of net impacts. Second, it seems unlikely that the state will cease being concerned about cost-effectiveness, and the Standard Practice Manual (California Public Utilities Commission 1987) will continue to serve as the guide for conducting such analyses. The state continues to rely on the total resource cost test (TRC) as a way of valuing both individual programs and portfolios of programs.

Decreasing NTGRs will affect the kWh and kW that are directly attributable to DSM programs, thus reducing DSM's contribution to the resource portfolio and utility earnings. Decreasing NTGRs will also affect the TRC,[9] which is still required of all programs. Proposals to address both low TRCs and NTGRs are presented below. In this discussion, we will address some of the key factors that can affect both the TRC and the NTGR.

The TRC

The key requirement to keep in mind is that a utility's entire utility portfolio of DSM programs must exceed a TRC of 1.0. However, while this may allow a given program to have a TRC less than 1, programs that have TRCs less than 1 invite scrutiny since there may be other, more effective programs by which to acquire both resources and earnings.

The TRC focuses on resource savings and counts benefits as utility avoided supply costs and costs as participant costs and utility program costs. It ignores any impact on rates. The somewhat simplified benefit and cost formulas for the TRC are presented in equations 1 and 2.

$$\text{Benefits} = \sum_{t=1}^{N} \frac{\text{Utility Avoided Costs}_t}{(1+d)^{t-1}} \qquad \textbf{Eqn. 3-1}$$

$$\text{Costs} = \sum_{t=1}^{N} \frac{\text{Utility Cost}_t + \text{Participant Cost}_t}{(1+d)^{t-1}} \qquad \textbf{Eqn. 3-2}$$

where

d= the discount rate
t= time

[9] The TRC and other tests are described in detail in the "Standard Practice Manual: Economic Analysis of Demand-Side Management Programs," prepared under the auspices of the California Public Utilities Commission and the California Energy Commission, 1987.

We note five important observations and clarifications of the TRC:

1. The participant costs are defined as the incremental cost of measures over the standard replacement measures. The gross amounts of these costs are reduced by the appropriate NTGRs for the particular measure or end use.

2. The benefits in the TRC are based on the net kWh and kW impacts of a program.

3. The TRC treats utility incentives paid to participants as transfer payment (from all ratepayers to participants through increased revenue requirements) rather than as a cost of the utility program.[10] Thus, while reducing the size of the incentive may seem attractive as a means of improving cost-effectiveness, it will have no effect.

4. The State's interest in cost-effectiveness in this highly volatile environment is reflected in Pub. Util. Code §399.15(b)(8), which states that: "AB 970 directs the Commission to reexamine the methodologies used for cost-effectiveness, and revise them in '*in light of increases in wholesale electricity costs and of natural gas costs to explicitly include the system value of reduced load on reducing market clearing prices and volatility*." In mid-September, the California Measurement Advisory Committee (CALMAC) sponsored a series of public workshops focusing on PY 2001 energy-efficiency programs. Based on these workshops, the CALMAC filed a report on avoided costs on October 2. Finally, on October 25, 2000, underscoring the importance of capturing the system value of reduced load on reducing market clearing prices, ALJ Bytof ruled that for PY 2001 programs, the utilities should use the following on-peak escalators: 1) PYs 2001-2002: 4.0X; 2) PYs 2003-2005: 3.5X; and 3) PYs 2006-2025: 3.0X. The decision on off-peak escalators was postponed. Clearly, such an increase in on-peak avoided costs will to some extent offset any decreases in the NTGRs.

5. There are other benefits, beyond the avoided utility supply costs, that are not explicitly included in the TRC equation. These other benefits are environmental adders and transmission and distribution. Approximately 1¢ per kWh is added for *each* of these benefits. In light of increased reliance, in the short-term, on coal, and the near consensus on the threat of global warming, the environmental adder, based on further study, should be increased. Other benefits should also be explored such as a number of health and economic benefits including California business retention.

[10] The term "transfer payments" generally refers to payments by the government sector to the household sector. The three most important transfer payments in our economy are for Social Security, unemployment compensation, and welfare. The intent of these transfer payments is to redistribute income and thus the goods and services that can be had with the income. Transfer payments surface as income received but not earned added to national income to derived personal income.

NTGRs

There are two issues that could legitimately affect the NTGR. The first is spillover and the second is possibility that some approaches to estimating NTGRs might be biased.

Spillover

When relying on the TRC as a measure of cost-effectiveness, the identification of spillover can have a significant impact on the NTGR since spillover can be added to the numerator of the NTGR, thus increasing the NTGR. For example, if the gross impacts were estimated to be 1,000,000 kWh and the net impacts (those promoted/caused by the program) were estimated to be 500,000 kWh, then the NTGR would be 0.50. However, if an additional 100,000 kWh were identified as spillover (participant and/or nonparticipant spillover), then the net impacts become 600,000 kWh and the NTGR increases to 0.60.

However, to date, utilities have not taken full advantage of spillover benefits.[11] This is unfortunate because the identification of spillover will allow those responsible for demand planning in California to better assess the need for supply-side resources in light of the full magnitude of demand-side resources. In addition, the identification of spillover will reduce the chances that a DSM program is terminated because it not cost-effective and increase the chances that a utilities are fairly compensated for their investments in DSM programs.

Note that, while the evaluations of the 1999, 2000, and 2001 SPC Programs included the estimation of spillover, *the estimated NTGRs for these program years were not adjusted to take into account these spillover estimates*. For the 1999 SPC Program, the estimated spillover-based adjustment to the NTGR was +0.23. For the 2000 SPC Program, the estimated adjustment was +0.17, and for the 2001 SPC Program, the adjustment was +0.27.[12] While these estimates certainly represent an upper estimate, it does suggest that a conservative spillover adjustment of 0.05 could be used, if verified through on-site inspections at some point in the future.

Estimation Techniques

As discussed earlier, one approach, the M&E-Protocol-sanctioned technique called “self-report,” appears to be biased downward. An upward adjustment to the NTGR should be explored for those programs for which the self-report technique is permitted.

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[11] We examined 125 evaluation reports filed by PG&E and SCE during the period 1994-1998 to determine the percent of these studies at the end use level that attempted to measure spillover and whether those that did eventually filed spillover-adjusted NTGRs with the CPUC. Our review revealed that 42% of the studies measured spillover (participant and/or nonparticipant spillover) and of these 56% filed a spillover-adjusted NTGR with the CPUC. Put another way, of the 125 studies, 23% filed a spillover-adjusted NTGR with the CPUC.

[12] For details regarding the estimation of spillover in these reports, see: 1) “Evaluation of the 1998 Nonresidential Standard Performance Contract Program: Volume I: Final Report.” Prepared for the Southern California Edison Company by XENERGY, 1999, 2) 1999 Nonresidential Large SPC Evaluation Study: Final Report.” Prepared for Pacific Gas and Electric by XENERGY, Inc., 2000, and 3) “2000 And 2001 Nonresidential Large SPC Evaluation Study: Final Report.” Prepared for Pacific Gas and Electric by XENERGY, Inc., 2001.

TRC Sensitivity Analysis

The large 1999 SPC Program was examined to determine how sensitive the TRC was to changes in the NTGR.[13] Since this was prior to ALJ Bytof's ruling on October 25, 2000, the analysis was done using the avoided costs that did not include the on-peak escalators. Nevertheless, the NTGR was very insensitive to any changes to the NTGR. For example, a NTGR of 1 results in a TRC of 3.91 and an NTGR of 0.1 results in a TRC of 1.95. A NTGR of 0.037 produced a TRC of 1. These results for the SPC program are unusual for a number of reasons:

1. The utility administrative costs represent only about 15 percent of the total program costs (program administrative costs plus program incentives). Put another way, incentives account for 85 percent of the total program costs. Recall that the program incentives are not treated as a program costs in the TRC.

2. The annual gross savings are large.

3. The effective useful lives (EULs) of the measures installed are relatively long on average (15 years).

Recall also that the participant costs (the incremental measure costs) are net and therefore any change in the NTGR affects both the benefits and the participant costs.

Other programs whose administrative costs are a greater fraction of the total program costs (administration and incentives), whose EULs are shorter, or whose unit savings are smaller will certainly be more sensitive to any changes in the NTGR.

A Final Option

Above, we have laid out three options to obtaining a better estimate of the TRC and the NTGR:

1. Identify additional benefits to be used in TRC calculations
2. Identify spillover whenever possible
3. Make an upward adjustment to NTGRs estimated using the self-report approach.

However, there are two problems that may make these options untenable, at least in the short run. First, it is possible that**,** *in the short term*, very little spillover can be identified since it may take some time for measurable spillover effects to emerge among participants in the PY 2000 and PY 2001 SPC Programs. The second problem is that, in this current turbulent environment, attribution of the installed measures to the SPC Program may become increasingly difficult for participants, adding to the uncertainty surrounding the NTGR. This is because there are so many other factors, in addition to the SPC Program, that could affect the decision to install the efficient

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[13] Data provided by SCE.

equipment. Two key factors are significant increases in the price of electricity and information regarding energy efficiency.

Both the lack of spillover in the short term and increased uncertainty in the participants' minds regarding the role of the SPC Program in their decision to install the efficient equipment could continue to suppress the NTGR. In the short-term, a more prudent course may be to suspend the estimation of the NTGR and use a default NTGR that is a more reasonable estimate of the NTGR. This default should take into account the likelihood that the self-report method is biased downward and that some spillover is very likely. One could adjust the NTGR by +0.10 to reflect the fact the self-report technique is biased and by an additional +0.05 to account for spillover. The 0.05 is considered to be a conservative estimate, given the spillover estimates for the 1999, 2000, and 2001 SPC Programs reported earlier in this chapter.

Earlier, in Section 1.3, we stated that in the current regulatory environment, it would be difficult to abandon or significantly modify the M&E Protocols with respect to net impacts. To do so might seriously reduce the confidence of key stakeholders in the estimates of net impacts. However, one could argue that the turbulence in this environment and the resulting uncertainty surrounding NTGRs could increase to such a point that resistance, on the part of key stakeholders, to *temporarily* abandoning the net-impact portion of the M&E Protocols for the SPC Programs would lessen. If that were to happen, a default NTGR could be negotiated. During this period, the evaluation of the SPC Program could continue to focus on verifying spillover, estimating gross impacts, conducting process evaluations, developing market characterizations, and estimating savings potential. Once the environment stabilizes, it is vital that utilities resume estimating net program impacts.

4 FINDINGS AND RECOMMENDATIONS

The research objectives established for this study will serve as the framework for presenting the findings and recommendations.

4.1 OBJECTIVE 1: EXPLORATION OF THE REASONS FOR HIGH FREERIDERSHIP

4.1.1 Findings

- In the 1998 and 1999 SPC Programs:
    - Lighting projects accounted for 58 percent of the measures installed followed by HVAC with 22 percent.
    - Lighting has an average NTGR of 0.40, which is the lowest of all end uses.
    - Commercial customers tend overwhelmingly to use the services of an EESP and projects sponsored by EESPs tend to have higher NTGR.

- Regression analysis of the 1998 and 1999 SPC Programs revealed that both the number of measures installed and the desire to reduce energy costs were significantly and positively related to the NTGR. In addition, the NTGRs were lower for those customers who thought about installing the efficient equipment prior to hearing about the SPC Program. Also, while evidence suggests that the greater engineering sophistication of facility managers at large commercial and industrial sites also contributes to the low NTGR, regression models could detect only a negative and moderate size effect. Interestingly, whether one has developed a policy for energy efficiency, the type of customer (commercial, industrial, or other), and whether one applied as a self-sponsor or through an EESP has no significant impact on the NTGR.

- Logistic regression analysis found only a few good predictors of why customers choose to sponsor their own projects rather than selecting an EESP sponsor. The odds of applying through an EESP go up by a factor of more than 4 as more measures are installed. Of course, the causal direction is unknown (i.e., it might be that EESPs simply find more measures to install for their customers). If a customer's average monthly electric bill is high, the odds that they will apply through an EESP are approximately half of those of a customer whose electric bill is low; that is, small customers tend to apply through an EESP. Also, odds that customers in the commercial sector will participate via an EESP are three times those of non-commercial customers.

- While the effect of repeat participation in the SPC Program on NTGRs was explored, there were too few cases available for a reliable analysis.

4.1.2 Recommendations

- One should explore focusing more on medium-size commercial customers since we expect that their NTGRs will be larger (have the fewest freeriders). However, this should not be done to the exclusion of other industrial and commercial customers.
- The SPC Program should continue to fine-tune the acceptance criteria for lighting projects since this type of project/measure has the highest freeridership.

4.2 OBJECTIVE 2: INVESTIGATION OF THE ACCURACY AND STABILITY OF THE SPC NTGRS

4.2.1 Findings

- The NTGR is only moderately sensitive to the questions used to derive it, scale transformations, and weighting schemes. While this suggests that the NTGR is stable, it does not necessarily mean that it is an unbiased estimate.
- Qualitative analysis of additional questions related to customers' decision-making processes generally supported the quantitative estimates of the NTGRs. This means that the story surrounding customers' motives for installing the efficient equipment is internally consistent and that our quantitative estimate is, for the most part, reliable. Again, this is not to say that it is unbiased.
- Using historical data from 1994 through 1998 for all evaluations, we found no trends over time (1994 through 1997) in the NTGRs of each customer class (commercial, industrial, agricultural, and residential). There are no trends by end use, except for lighting, which is decreasing over time.
- Using historical data from 1994 through 1998 for all evaluations, we found that NTGRs vary by SIC codes.

4.2.2 Recommendations

- We have only one recommendation regarding the questions and the algorithms used to estimate the NTGR, and that is to explore a different set of weights to reflect the increased value of accelerating the installation of energy-efficiency projects. This could increase the NTGR by 4 to 5 percentage points.
- We do not recommend the combined use of both quantitative and qualitative data analyses to estimate NTGRs for *all* SPC participants. For most participants, the quantitative analysis alone appears to be sufficient[1]. However, such a combined approach would be worth performing for those participants with the largest savings since even

[1] We remind the reader that a *qualitative* analysis has always been and will continue to be routinely conducted in those cases where the answers to the battery of quantitative NTGR questions are inconsistent. In such cases, this qualitative analysis involves a review of customer responses to all relevant closed and open-ended questions regarding their decision to install the efficient equipment in an attempt to resolve the inconsistencies.

small changes in their NTGRs can produce large impacts on the savings-weighted NTGR for the program.

- As noted earlier, lighting projects should be reduced because of their relatively low NTGRs.
- While it is interesting that NTGRs vary by SIC classification, it is unclear that these results are generalizable to the SPC Program, which is very different from the other non-residential programs that were implemented from 1994 through 1998 and may have attracted a different mix of customers.

4.3 Objective 3: Assessment of Bias in NTGR Estimation Techniques

4.3.1 Findings

- There appears to be a downward bias associated with using the self-report approach.

4.3.2 Recommendation

We recommend the negotiating a standard upward adjustment to NTGRs estimated using the self-report approach. We recommend a minimum adjustment of +0.10.

4.4 Objective 4: Assessment of Price Effect on NTGRs and TRCs and Possible Responses

4.4.1 Findings

- The concern for *net* impacts and the M&E Protocols used to estimate these impacts as well as a concern for cost-effectiveness are likely to persist.
- Whether an increase in price will reduce or increase the NTGR depends on the mix of customers and technologies that choose to join the SPC in an environment characterized by higher prices and lower reliability.
- Spillover has not been fully addressed in past evaluations or in the M&E Protocols. However, note that the evaluations of the 1999, 2000, and 2001 SPC Programs included the estimation of spillover. *However, the estimated NTGRs for these program years were not adjusted to take into account these spillover estimates*. For the 1999 SPC Program, the estimated spillover-based adjustment to the NTGR was +0.23. For the 2000 SPC Program, the estimated adjustment was +0.17, and for the 2001 SPC Program, the adjustment was +0.27.[2] While these estimates certainly represent an upper estimate, it does suggest that a conservative spillover adjustment of 0.05 could be used if verified through on-site inspections at some point in the future.

[2] For details regarding the estimation of spillover in these reports, see: 1) "Evaluation of the 1998 Nonresidential Standard Performance Contract Program: Volume I: Final Report." Prepared for the Southern California Edison Company by XENERGY, 1999, 2) 1999 Nonresidential Large SPC Evaluation Study: Final Report." Prepared for Pacific Gas and Electric by XENERGY, Inc., 2000, and 3) "2000 And 2001 Nonresidential Large SPC Evaluation Study: Final Report." Prepared for Pacific Gas and Electric by XENERGY, Inc., 2001.

- The TRC for the SPC Program is very insensitive to even dramatic reductions in the NTGR. This is not the case for other programs whose administrative costs are a greater fraction of the total program costs (administration and incentives), whose effective useful lives are shorter, or whose average per-unit savings are smaller.
- While environmental and T&D benefits have for some time been treated as benefits, on-peak escalators have only been recently been approved by the CPUC and can to some extent offset any decreases in NTGRs. A decision regarding off-peak escalators has yet to be made.

4.4.2 Recommendations

- Assess the return on investing additional evaluation dollars to measure spillover. If the return on such an investment seems reasonable, we recommend immediately expanding on the one page currently devoted to discussing spillover in Appendix J of the M&E Protocols. This is necessary since pursuing more spillover that results in upward adjustments to NTGRs will invite more scrutiny from the CPUC. A good source upon which to base modifications to Appendix J is a report on methods for estimating spillover produced by Cambridge Systematics (1994).
- Explore the identification of other benefits, such as the economic benefits associated with the retention of jobs in California and health benefits, not currently included in the various benefit-cost tests.
- Given that it may require as much as several years for spillover to occur and be measured and that participants may become more uncertain (due to the turbulent environment created by deregulation) regarding the role of the SPC Program in their decision to install the efficient equipment, one should at least consider the short-term, *temporary*, use of a default NTGR that incorporates and upward adjustment of 0.10 to account for the bias in the self-report technique and an additional upward adjustment of 0.05 to account for spillover. An additional increase could be obtained by assigning a different set of weights to reflect the increased value of accelerating the installation of energy efficiency projects. During this period, the SPC evaluations could focus on verifying spillover, estimating gross impacts, conducting process evaluations, developing market characterizations and customer targeting, and estimating savings potential. Once the environment stabilizes, it is vital that utilities resume estimating net program impacts.

4.5 FURTHER RESEARCH

While data from the evaluation of the 2000 and 2001 SPC Programs were not available for this analysis, we do not expect that the inclusion of these data into our analyses would substantially change the conclusions and recommendations contained in this report. However, in order to provide a more comprehensive analysis, it might be useful to incorporate these two program years into our analysis at a later date.

A

ESTIMATING NTGRS USING PARTICIPANT SELF REPORTS

This appendix contains pages 47 through 59 excerpted from Appendix J of the M&E protocols. This section addresses a variety of issues relating to the self-reporting method of estimating NTGRs.

A.1 ISSUES SURROUNDING THE VALIDITY AND RELIABILITY OF SELF-REPORT TECHNIQUES

A central intent of utility DSM program evaluations is to identify that portion of the gross load impacts associated with a program-supported measure installation that would not have been accomplished in the absence of the program. That portion is the net load impacts. In some cases, net load impacts may be estimated directly using regression models. Where it is not possible to use regression models, an alternate approach to estimating the program impact that is due to freeridership and the net-to-gross ratio (NTGR) (defined as 1 minus the proportion of freeridership) may be required. This approach commonly involves the use of the self-report method, i.e., asking program participants directly whether they would have installed the same thing without the program. This technique must deal with several methodological problems.

One of the problems inherent in asking program participants if they would have installed the same equipment or adopted the same energy-saving practices without the program is that we are asking them to recall what has happened in the past. Worse than that is that what we are really asking them to do is report on a hypothetical situation. In many cases, the respondent may simply not know and/or cannot know what would have happened in the absence of the program. Even if the customer has some idea of what would have happened, there is, of necessity, uncertainty about it.

The situation just described is a circumstance ripe for biased answers and answers with low reliability, where reliability is defined as the likelihood that a respondent will give the same answer to the same question whenever or wherever it is asked. It is well known in the interview literature that the more factual and concrete the information the survey requests, the more accurate responses are likely to be. Where we are asking for motivations and processes in hypothetical situations that occurred 1 or 2 years ago, there is room for bias. Bias in responses is commonly thought to stem from two origins. First, some respondents may believe that claiming no impact for the program is likely to cause the program to cease, thus removing future financial opportunities from the respondent. Closely related to this is the possibility that the respondents may want to give an answer that they think will be pleasing to the interviewer. The direction of the first bias would be to increase the NTGR, and the second would have an unclear effect–up or down, depending on what the respondent thinks the interviewer wants to hear.

The other commonly recognized motivation for biased answers is that some people will like to portray themselves in a positive light; e.g., they might like to think that they would have installed energy-efficient equipment without any incentive. This type of motivation could result in an artificially low NTGR.

Even though the situations of interest have occurred in the past, and judgments about them involve hypothetical circumstances, they are often complex. No one set of questions can apply to all decision processes that result in a program-induced course of action. Some installations are simple, one-unit measures, while others involve many units, many different measures, and installations taking place over time. The decision to install may be made by one person or several people in a household, an individual serving as owner/operator of a small business, or, in the case of large commercial, industrial, or agricultural installations, by multiple actors at multiple sites. Some measures may have been recommended by the utility for years before the actual installation took place, and others may have been recommended by consultants and/or vendors, making the degree of utility influence difficult to pin down. Some efficiency projects may involve reconfiguration of systems rather than simple installations of energy-efficient equipment.

This complexity and variation across sites requires thoughtful survey instrument design. The following is a listing and discussion of the essential issues that should be considered by evaluators using self-report methods, together with some recommendations on reporting the strategies used to address each issue.

These should be regarded as recommendations for minimum acceptable standards for the use of self-report methods to estimate NTGRs. Much of this chapter focuses on self-report methodologies for developing NTGRs for energy efficiency improvements in all sectors regardless of the size of the expected savings and the complexity of the decision-making processes. However, in a given year, energy efficiency programs targeted for industrial facilities are likely to achieve a relatively small number of installations with the potential for extremely large energy savings at each site. Residential programs often have a large number of participants in a given year, but the energy savings at each home, and often for the entire residential sector, are small in comparison to savings at non-residential sites. Moreover, large industrial customers have more complex decision-making processes than residential customers. As a result, evaluators are significantly less likely to conduct interviews with multiple actors at a single residence or to construct detailed case studies for each customer – methods that are discussed in detail in the following sections. It may not be practical or necessary to employ the more complex techniques (e.g., multiple interviews at the same site, case-specific NTGR development) in all evaluations. Specifically, Sections 4.2, 4.5, 4.7, 4.9, and 4.12 in Appendix J are probably more appropriate for customers with large savings and more complex decision-making processes. Of course, evaluators are free to apply the guidelines in these sections even to customers with smaller savings and relatively simple decision-making processes.

A.2 IDENTIFYING THE CORRECT RESPONDENT

Recruitment procedures for participation in an interview involving self-reported NTGRs must address the issue of how the correct respondent(s) will be identified. Complexities to be addressed include situations commonly encountered in large commercial and industrial facilities, such as:

1. Different actors have different and complementary pieces of information about the decision to install, e.g., the CEO, CFO, facilities manager, etc.
2. Decisions are made in locations such as regional or national headquarters that are away from the installation site.
3. Significant capital decision-making power is lodged in commissions, committees, boards, or councils.
4. Both a technical decision-maker and a financial decision-maker need to be interviewed (and in these cases, how the responses are combined will be important).

An evaluation using self-report methods should employ and document rules and procedures to handle all of these situations in a way that assures that the person(s) with the authority and the knowledge to make the installation decision are interviewed.

A.3 SET-UP QUESTIONS

The decisions that the net-to-gross questions are addressing may have occurred as long as 2 years prior to the interview. Regardless of the magnitude of the savings or the complexity of the decision-making process, questions may be asked about the motivations for making the decisions that were made, as well as the sequence of events surrounding the decision. Sequence and timing are important elements in assessing motivation and program influence on it. Unfortunately, sequence and timing will be difficult for many respondents to recall 2 years later, which is the standard schedule for first-year load impact evaluations governed by the protocols. This makes it essential that the interviewer guide the respondent through a process of establishing benchmarks against which to remember the events of interest. Failure to do so could well result in, among other things, the respondent “telescoping” some events of interest to him into the period of interest to the evaluator. Motivations, competing alternatives, and battles lost could recede in memory. Set-up questions that set the mind of the respondent into the train of events that led to the installation and that establish benchmarks can minimize these problems. However, one should be careful to avoid wording the set-up questions in such a way so as to bias the response in the desired direction.

Set-up questions should be used at the beginning of the interview, but they can be useful in later stages as well. Respondents to self-report surveys frequently are individuals who participated in program decisions and, therefore, may tend to provide answers ex post that validate their position in those decisions. Such biased responses are more likely to occur when the information sought in questions is abstract, hypothetical, or based on future projections and are less likely to occur when the information sought is concrete. To the extent that questions prone to bias can incorporate concrete elements, either by set-up questions or by follow-up probes, the results of the interview will be more persuasive.

An evaluation using self-report methods should employ and document a set of questions that adequately establish the set of mind of the respondent to the context and sequence of events that led to decision(s) to adopt a DSM measure or practice, including clearly identified benchmarks in the customer's decision-making process.

A.4 Use of Multiple Measures

Regardless of the magnitude of the savings or the complexity of the decision-making process, one should assume that using multiple questionnaire items (both quantitative and qualitative) to measure one construct is preferable to using only one item, as it is well-documented in the measurement literature that reliability is increased by the use of multiple items unless some items are uncorrelated with the other items (Blalock, 1970; Crocker & Algina, 1986; Duncan, 1984).

A.5 Use of Multiple Respondents

In situations with relatively large savings and more complex decision-making processes, one should use, to the extent possible, information from more than one person familiar with the decision to install the efficient equipment or adopt energy-conserving practices or procedures (Patten, 1987; Yin, 1994).

A.5.1 Measures of Reliability

The internal consistency of multiple-item scales should not be assumed. Techniques available for testing reliability include split-half correlations, alternate forms tests, and Cronbach's alpha (Nunnally, 1978; Crocker & Algina, 1986; Cronbach, 1951; DeVellis, 1991). An evaluation using self-report methods should employ and document some or all of these tests or other suitable tests to evaluate reliability, including a description of why particular tests were used and others were considered inappropriate.

For those sites with relatively large savings and more complex decision-making processes, both quantitative and qualitative data may be collected from a variety of sources (e.g., telephone interviews with the decision maker, telephone interviews with others at the site familiar with the decision to install the efficient equipment, paper and electronic program files, and on-site surveys). These data must eventually be integrated in order to produce a final NTGR.[1] Of course, it is essential that all such sites be evaluated consistently using the same instrument. However, in a situation involving both quantitative and qualitative data, interpretations of the data may vary from one evaluator to another, which means that, in effect, the measurement results may vary. Thus, the central issue here is one of reliability, which can be defined as obtaining consistent results over repeated measurements of the same items.

[1] For a discussion of the use of qualitative data, see Section 4.11.

To guard against such a threat at those sites with relatively large savings and more complex decision-making processes, the data for each site should be evaluated by more than one member of the evaluation team. Next, the resulting NTGRs for the projects should be compared, with the extent of agreement being a preliminary measure of the so-called inter-rater reliability. Any disagreements should be examined and resolved, and all procedures for identifying and resolving inconsistencies should be thoroughly described and documented (Sax, 1974; Patton, 1987).

A.5.2 Handling Apparent Inconsistencies

When multiple questionnaire items are used to calculate a freeridership probability, there is always the possibility of apparently contradictory answers. Contradictory answers indicate problems of validity and/or reliability (internal consistency). Occasional inconsistencies indicate either that the respondent has misunderstood one or more questions or is answering according to an unanticipated logic. Apparent inconsistencies should be identified and handled before the interview is over. If the evaluator waits until the interview is over to consider these problems, there may be no chance to correct misunderstandings on the part of the respondent or to detect situations where the evaluator brought incomplete understanding to the crafting of questions. In some cases, the savings at stake may be sufficiently large to warrant a follow-up telephone call to resolve the inconsistency.

However, despite the best efforts of the interviewers, some inconsistencies may remain. When this occurs, evaluators could decide which of the two answers, in their judgement has less error, and discard the other. Or, the two inconsistent responses could be weighted in a way that reflects the evaluators' estimate of the error associated with each; i.e., a larger weight could be assigned to the response that, in their judgement, contains less error.

Finally, an evaluation report using self-report methods should describe the approach to identifying and resolving apparent inconsistencies. The report should include:

1. A description of contradictory answers that were identified
2. Whether and how it was determined that the identified inconsistencies were significant enough to indicate problems of validity and/or reliability (internal consistency)
3. How the indicated problems were mitigated. These rules for resolving inconsistencies should be established, to the extent feasible, before the analysis begins.

Details regarding the establishment and use of such rules are provided in Section 4.11.2 of Appendix J.

A.5.3 Consistency Checks

One of the potential problems with self-report methods is the possibility of answering the questions in a way that conforms to the perceived wishes of the interviewer or that shows the respondent in a good light. One way to mitigate these tendencies is to ask one or more questions specifically to check the consistency and plausibility of the answers given to the core questions.

Inconsistencies can highlight efforts to “shade” answers in socially desirable directions. While consistency checking won’t overcome a deliberate and well-thought-out effort to deceive, it will often help where the process is subtler or where there is just some misunderstanding of a question.

An evaluation using self-report methods should employ a process for setting up checks for inconsistencies when developing the questionnaire items and describe and document the methods chosen as well as the rationales for using or not using the techniques for mitigating inconsistencies.

A.6 MAKING THE QUESTIONS MEASURE-SPECIFIC

It is important for evaluators to tailor the wording of central freeridership questions to the specific technology or measure that is the subject of the question. It is not necessarily essential to incorporate the specific measure into the question, but some distinctions must be made if they would impact the understanding of the question and its potential answers. For instance, when the customer has installed equipment that is efficiency rated so that increments of efficiency are available to the purchaser, asking that respondent to indicate whether he would have installed the same equipment without the program could yield confusing and imprecise answers. The respondent will not necessarily know whether the evaluator means the exact same efficiency, some other equipment at similar efficiency, or just some other equipment of the same general type. Some other possibilities are:

1. Installations that involve removal more than addition or replacement (e.g., delamping or removal of a second refrigerator or freezer in a residence)
2. Installations that involve increases in productivity rather than direct energy load impacts
3. Situations where the energy-efficiency aspect of the installation could be confused with a larger installation
4. Installation of equipment that will result in energy load impacts but where the equipment itself is not inherently energy efficient.

An evaluation using self-report methods should include and document an attempt to identify and mitigate problems associated with survey questions that are not measure specific and an explanation of whether and how those distinctions are important to the accuracy of the resulting estimate of freeridership.

A.7 PARTIAL FREERIDERSHIP

Partial freeridership can occur when, in the absence of the program, the participant would have installed something more efficient than the program-assumed baseline efficiency but not as efficient as the item actually installed as a result of the program. When there is a likelihood that this is occurring, an evaluation using self-report methods should include and document attempts to identify and quantify the effects of such situations on net savings. Partial freeridership should be explored for those customers with large savings and complex decision-making processes.

In such situations, it is essential to develop appropriate and credible information to establish precisely the participants' alternative choice. The likelihood that the participant would really have chosen a higher efficiency option is directly related to their ability to clearly describe that option.

An evaluation using self-report methods should include and document attempts to identify and mitigate problems associated with partial freeridership, when applicable.

A.8 DEFERRED FREERIDERSHIP

Deferred free riders are those customers who would, in the absence of the program, have installed exactly the same equipment that they installed through the utility DSM program, but the utility induced them to install the equipment earlier than they would have otherwise. That is, the utility *accelerated* the timing installation of the equipment. Because determining the extent of utility influence on the timing of the installation is a complex process, an evaluator should avoid relying on a single question asked of the key decision-maker. Rather, an evaluator should examine all available data and determine whether the preponderance of evidence supports the conclusion of deferred freeridership. Data from such sources as additional closed- and open-ended questions asked of the key decision-maker, information obtained from other people at the site familiar with the decision to install the efficient equipment, and information gathered from the program paper files should also be collected and analyzed. Rules for integrating the responses to closed- and open-ended questions should be established, to the extent feasible, before the analysis begins. Details regarding the establishment and use of such rules are provided in Section A.12.

Unfortunately, evaluation budgets may only permit such data to be collected and analyzed for those customers with larger savings. For those customers with smaller savings, the NTGR may be based only on the responses from close-ended questions obtained from the key decision-maker. In such cases, closed-ended questions regarding utility influence on both *what* was installed and *when* it was installed could be asked. These answers could be analyzed mechanically using an algorithm. However, to the extent that closed-ended questions are unable to capture fully the complexity of the decision-making process, any resulting conclusions regarding deferred freeridership may be biased, with the direction of the bias unknown.

Whenever deferred freeridership is identified by a utility, the onus is on the utility to account for such freeridership in the stream of future utility savings. This could be done by calculating a *lifecycle* NTGR and applying it throughout the effective useful life of the equipment. Or, a utility could calculate a *first-year* NTGR and adjust the stream of savings to account for the fact that the savings associated with deferred free riders will be reduced to zero in the year in which they said they would have installed the same equipment in the absence of the program.

A.9 THIRD-PARTY INFLUENCE

Currently, there is no standard method for capturing the influence of third parties on customer's decision to purchase energy-efficient equipment. Third parties who may have influence in this context include market actors such as store clerks, manufacturers (through promotional literature, demonstrations, and in-person marketing by sales staff), equipment distributors, installers, developers, engineers, energy consultants, and architects. When one chooses to measure the effect of third parties, one should keep the following principles in mind:

- The method chosen should be balanced. That is, the method should allow for the possibility that the third-party influence can increase or decrease the NTGR that is based on the customer's self report.
- The rules for deciding which customers will be examined for potential third-party influence should balanced. That is, the pool of customers selected for such examination should not be biased towards ones for whom the evaluator believes the third-party influence will have the effect of influencing the NTGR in only one direction.
- The plan for capturing third-party influence should be based on a well-conceived causal framework.
- The onus is on the evaluator to build a compelling case using a variety of quantitative and/or qualitative data for changing the customer's NTGR.

A.10 SCORING ALGORITHMS

A consequence of using multiple questionnaire items to assess the probability of freeridership (or its complement) is that decisions must be made about how to combine them. Should two items be averaged or should one supersede the other? Do all items have equal weight or are some more important indicators than others? Answers to these questions can have a profound effect on the final NTGR estimate. These decisions are incorporated into the algorithm used to combine all pieces of information to form a final result. All such decisions must be described and justified by evaluators.

A.11 HANDLING NON-RESPONSES AND "DON'T KNOWS"

In this section, we address the situation where customers selected for the evaluation sample refuse to be interviewed or do not complete an attempted interview or questionnaire. When this happens, a decision must be made about how to treat that case in the process of aggregating participant-level results to program-level results. For example, making no decision assumes that the non-respondents would have answered the questions at the mean. Thus, their NTGRs would assume the mean value. This may or may not be a reasonable assumption, but it should not go unexplained. It is essential to do an analysis to determine the characteristics of the non-respondents in order to decide what assumptions should be made about their unanswered questions. Evaluators should do such an analysis and make judgments on what customer characteristics are likely to be relevant to answers to net-to-gross questions. These judgments and the decisions that flow from them must be described and rationales provided for them.

Respondents who do answer interview questions may nevertheless answer some questions with a “don’t know” response. When this answer is received for a question included in the net-to-gross algorithm, decisions must be made about how to handle such a response. It is clear that some questions are more central than others, implying different assumptions and decisions. A decision about a “don’t know” answer to core questions concerning what the respondent would have done absent the program may well be different than the decision about handling the “don’t know” answer to a question about the timing of learning about the program or the timing of measure installation without the program. Evaluators should decide, in advance, how to handle “don’t know” answers and justify those decisions.

A.12 THE USE OF QUALITATIVE DATA AND REPORTING REQUIREMENTS

The M&E Protocols focus entirely on quantitative methods that stress such elements as quasi-experiments, paper and pencil “objective” instruments containing closed-ended questions, and multivariate statistical analyses. However, many DSM evaluators believe that additional *qualitative* data regarding the economics of the customer’s decision and the decision process itself can be very useful in supporting or modifying *quantitatively* based results (Britan, 1978; Weiss and Rein, 1972; Patton, 1987). *Qualitative* methods stress in-depth, open-ended interviews, direct observation, and written documents, including such sources as open-ended questions and program records.

There is wide agreement on the value of *both* qualitative and quantitative data in the evaluation of many kinds of programs. Moreover, it is inappropriate to cast either approach in an inferior position. The complexity of organizational decisions regarding the purchase of efficient equipment can be daunting, especially in large organizations for which the savings are often among the largest. In such situations, the reliance on only quantitative data can miss some important elements of the decision. The collection and interpretation of qualitative data can be especially useful in broadening our understanding of a utility’s role in this decision.

When one chooses to complement a quantitative analysis of the NTGR with a qualitative analysis, there are a few very basic concerns that one must keep in mind.

A.12.1Data Collection

Information relevant to the purchase and installation decision can include:

- Program paper files (correspondence between DSM program staff and the customer, evidence of economic feasibility studies conducted by the utility or the customer, correspondence among the customer staff, other competing capital investments planned by the customer)
- Program electronic files (e.g., program tracking system data, past program participation)

- Interviews with other people at the site who are familiar with the program and the choice (e.g., operations staff)
- Open-ended questions on structured interviews with the key decision maker and other staff who may have been involved with the decision.

Where appropriate, for example, in the case of large-scale commercial and industrial sites, these data should be organized and analyzed in the form of a case study.

A.12.2Establishing Rules for Data Integration

Before the analysis begins, one should establish, to the extent feasible, rules for the integration of the quantitative and qualitative data. These rules should be as specific as possible and be strictly adhered to throughout the analysis. Such rules might include instructions regarding when the NTGR based on the quantitative data should be overridden based on qualitative data, how much qualitative data is needed to override the NTGR based on quantitative data, how to handle contradictory information provided by more than one person at a given site, how to handle situations when there is no decision-maker interview, when there is no appropriate decision-maker interview, or when there is critical missing data on the questionnaire, and how to incorporate qualitative information on deferred freeridership.

One must recognize that it is difficult to anticipate all the situations that one may encounter during the analysis. As a result, one may refine existing rules or even develop new ones during the initial phase of the analysis. One must also recognize that it is difficult to develop algorithms that effectively integrate the quantitative and qualitative data. It is therefore necessary to use one's judgement in deciding how much weight to given to the quantitative and qualitative data and how to integrate the two.

A.12.3 Analysis

A case study is an organized presentation of all the information available about a particular customer site with respect to all relevant aspects of the decision to install the efficient equipment. When a case study approach is used, the first step is to pull together the data relevant to each case and write a discrete, holistic report on it (the case study). In preparing the case study, redundancies are sorted out, and information is organized topically. *This information should be contained in the final report.*

The next step is to conduct a content analysis of these data. This involves identifying coherent and important examples, themes, and patterns in the data. The analyst looks for quotations or observations that go together and that are relevant to the *customer's decision to install the efficient equipment*. Guba (1978) calls this process of figuring out what goes together "convergence," i.e., the extent to which the data hold together or dovetail in a meaningful way. Of course, the focus here is on evidence related to the degree of utility influence in installing the efficient equipment.

Sometimes, *all* the data will clearly point in the same direction while, in others, the *preponderance* of the data will point in the same direction. Other cases will be more ambiguous. In all cases, in order to maximize reliability, it is essential that more than one person be involved in analyzing the data. Each person must analyze the data separately and then compare and discuss the results. Important insights can emerge from the different ways in which two analysts look at the same set of data. Ultimately, differences must be resolved and a case made for a particular NTGR.

Finally, it must be recognized that there is no single right way to conduct qualitative data analysis. The analysis of qualitative data is a creative process. There are no formulas, as in statistics. It is a process demanding intellectual rigor and a great deal of hard, thoughtful work. Because different people manage their creativity, intellectual endeavors, and hard work in different ways, there is no one right way to go about organizing, analyzing, and interpreting qualitative data. (p. 146)

Ultimately, if the data are systematically collected and presented in a well-organized manner, and if the arguments are clearly presented, any independent reviewer can understand and judge the data and the logic underlying any NTGR. Equally important, the independent reviewers will have all the essential data to enable them to replicate the results, and if necessary, to derive their own estimates.

A.13 WEIGHTING

The protocols require estimates of the NTGR at the end-use and program levels. Of course, such an NTGR must take into account the size of the impacts at the customer or project level. Consider two large industrial sites with the following characteristics: the first involves a customer whose self-reported NTGR is 0.9 and whose estimated annual savings are 200,000 kWh. The second involves a customer whose self-reported NTGR is 0.15 and whose estimated savings are 1,000,000 kWh. One could calculate an unweighted NTGR across both customers of 0.53. Or, one could calculate a weighted NTGR of 0.28. Clearly, the latter calculation is required.

It is critical to recognize that how these NTGRs are applied by utilities to estimate the stream of benefits and earnings can produce very different results. First, note that to produce a single end-use NTGR for all fuel impacts, one must first convert both gross and net kWh, kW, and therm impacts into a common metric, dollars.[2] Once converted, the total end-use net impacts can be divided by the total end-use gross impacts to produce an end-use NTGR. Now, suppose a utility calculates an end-use NTGR and applies it to the stream of kWh, kW, and therm impact estimates. When this is done, certain distortions can occur. For example, if a customer has relatively small kWh and kW impacts but enormous therm impacts, the therm impacts will dominate the end-use NTGR. If a utility, in calculating its earnings claim, applies this end-use NTGR to the separate benefits streams for kWh, kW, and therms contained in its E tables, the net *kWh and kW* impacts will be inflated. The appropriate approach is to calculate three separate

[2] This can be done using the marginal costs associated with various costing periods.

NTGRs for kWh, kW, and therms within each end use. A utility could then apply these NTGRs to the separate benefits streams for kWh, kW, and therms in their E tables.

A.14 ASSESSING SPILLOVER

Spillover is defined as: "Reductions in energy consumption and/or demand in a utility's service area caused by the presence of the DSM program, beyond program-related gross savings of participants. These effects could result from: (a) additional energy efficiency actions that program participants take outside the program as a result of having participated; (b) changes in the array of energy-using equipment that manufacturers, dealers, and contractors offer all customers as a result of program availability; and (c) changes in the energy use of non-participants as a result of utility programs, whether direct (e.g., utility program advertising) or indirect (e.g., stocking practices such as (b) above, or changes in consumer buying habits)."[3]

Part "a" of above definition is referred to as *participant spillover. The following recommendations apply only to estimating participant spillover.*

All of the measurement issues that have been identified in these guidelines for attributing installations of energy-efficient equipment to program influence apply to spillover installations as well. It is important to remember that evaluations that include savings from spillover measures must estimate the gross savings using the same level of methodological rigor that was used for program-induced measures and practices. In addition, there are extra hurdles that evaluators must address if a persuasive case is to be made for program influence on these installations. These hurdles stem from the fact that the identification of appropriate installations and their connection to a utility program is necessarily more vague (less concrete) than was the case for equipment specifically recommended or rebated by utilities. The reason is obvious. In traditional program evaluations, equipment is specified in program records, serving both the identification and the program connection functions. The issue is only in assessing the *level* of program impact on the installation decision at some point between 0 and 100 percent. For spillover measures, simply identifying the equipment and/or practices is at issue, as well as making any connection at all with a utility program. Evaluations that include spillover measures in net program impact should specify how each of the issues identified in this and previous sections have been addressed. Some acknowledgment of the "softness" of simple statements of utility influence, coupled with specific efforts to strengthen confidence in the statements, should be included in the evaluation report.

There are many issues surrounding the matter of defining what equipment and/or practices are appropriate for consideration in spillover analyses. These are beyond the scope of these guidelines. Criteria for what is appropriate will vary by the utility and are equally at issue for self-report as for other methods of assessing impact. The process of eliciting from the respondent what installations, modifications, and reconfigurations have been completed within a specified time period is important, but not subject to these guidelines, which are oriented only to

[3] *Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs*, page A-9.

self-reported program influence. It may be important, however, to state that identified spillover measures and/or practices must be separated from measures and/or practices that have been claimed for direct program influence in other evaluations. To avoid double counting, this will probably require that the respondent be informed of the installations listed in program tracking systems that have been claimed in other evaluations for direct program influence.

When installations have been identified as potential spillover cases, the respondent must be asked about the level of utility influence on the selection of the energy-efficient version of the equipment installed, modified, or reconfigured. Because the evaluator has eliminated from consideration all equipment directly associated with the utility's programs, any influence identified by the respondent will usually be indirect, i.e., less than concrete. It therefore becomes important to assess the credibility of any claims the respondent makes for utility influence on the decision. Usually this will mean asking questions that attempt to tie these "soft" claims to something more concrete. This might mean establishing the means by which the influence occurred, identifying third parties involved in the communication of information or in the influence of attitudes, and indicating a time period and context in which the influence took place. The more concrete the ties, the more persuasive the case for claimed influence will be.

B QUALITATIVE ANALYSIS OF 1999 SPC CUSTOMER DECISION MAKERS

B.1 CASE 1: A COMMUNITY COLLEGE WITH A NTGR OF 0.032

Analysis

This is an institution in PG&E's territory receiving Strata-3-level incentives. Its facility is approximately 400,000 square feet and has monthly electricity bills between $50,000 and $99,000. This is a single site location where the organization owns the facility and pays its own electricity bills.

This organization used the program incentive to install variable-speed drives (VSD) on chillers. The facilities director mentioned that they needed to comply with "CFC issues" and therefore may as well incorporate energy-efficiency measures at the same time. The interviewee said that he asked an EESP to look into the LNSPC Program as a rebate for implementing their energy and compliance needs. At the time of the interview, the customer had received a project installation report.

The participant first heard about the VSD equipment from a vendor and first heard about the LNSPC program from PG&E. The participant heard about the program before the decision to install or even think about installing the energy-efficient equipment. The customer developed the idea himself and decided on his own to pursue the installation. The customer is receiving a reduced fee, or will split the incentive with the EESP. The interviewee reported zero significance (on a 0-to-10 scale) from the EESP services on the decision to install the energy-efficiency measures. The respondent also said that the incentive was not significant (0 reported) in the decision to install the measure. The respondent said that the energy-efficiency measure was "a routine, scheduled maintenance project," and that they definitely would have installed the same efficiency-level equipment without the incentive, although it would have been about a year later. Their existing equipment was fully functional.

The organization does not use long-term investment analysis but has calculated the payback period for the measure as 12 months with incentives and 24 without.

No strengths of the program were mentioned, and the respondent said that they would never use the program again. It was "more trouble than it is worth," stating that the lengthy documentation was a burden.

The reason the organization picked the EESP was because of their lower price and up-front cost than the competitors. They selected the EESP by a request-for-proposal process, and used a performance contract because that is what the EESP offered them. They are currently receiving other services from the EESP (e.g., evaluating lighting).

The organization was already certain about the savings associated with the measure and does not plan to us the M&V results for any other purpose. They do not feel M&V is worth the trouble for this measure; however, depending on the situation, they may value M&V for other aspects of energy upgrades. The measures are not new, the respondent said, and they are extremely satisfied with the results of the measures. If they install any more energy-efficient technology, it will have nothing to do with participation in the program.

They have no formal energy related policies and no changes were made as a result of participating in the program.

While the calculated NTGR is about right, it could be reduced slightly to 0.0 as the project was routine, scheduled maintenance.

B.2 Case 2: A Mineral Processing Facility with a NTGR of 0.032

Analysis

This is a 50,000-square-foot industrial facility in SCE's territory with an average monthly electric bill of $100,000 to $500,000. While only one location was part of the LNSPC Program, there are multiple locations of the organization. There are two motors projects, one to upgrade a pumping system and one to upgrade a dryer. The incentive levels put them into Strata 3. They are self-sponsored, with an in-house consultant filling out forms, conducting M&V, and writing the necessary reports. The DPA was in the process of being accepted so installation was not yet complete at the time of the interview.

An additional dryer was needed to increase dryer throughput to meet forecasted production needs, and the existing pump is being replaced with a blower system to double productivity. The company was already aware of the equipment through a previous installation and heard about the LNSPC Program from SCE after the installation had begun. They reported that the incentives offered by the program had no influence on the decision to install and would have installed equipment with the same level of efficiency in absence of the program within the year.

The organization uses long-term investment analysis for energy equipment selection, with a standard 4-year payback criterion. They estimated that the payback without the LNSPC incentive was 4 years, and that the incentives accounted for 9 percent of the incremental cost of the project.

This is the first time the organization participated in the LNSPC and they were seeing how it went with this project. They liked the incentive and appreciated that the utility brought it to their attention but commented that the paperwork took a considerable amount of time. The results will be written up and shared internally as part of a cost improvement program. They are "always upgrading, electricity is the largest expense…always looking for efficiency."

They are not planning on installing these or other measures as a result of participating in the program. They also stated that they were somewhat uncertain about the estimated savings when they first decided to install the measures, and they plan to use the M&V results to justify future projects if this project is successful.

They estimated that the costs for M&V on the pump would be 5 percent and the dryer 25 percent of the incentives, respectively, with an overall average cost of M&V to be 15 percent of the incentive. The interviewee was unable to comment on whether the organization would be willing to pay for M&V in absence of the program requirement to do so.

The organization does not have specification policies for the selection of energy-efficient equipment but does have reward policies for managing energy costs through recognition in the cost improvement program. No new practices or changes to existing organizational or decision-making practices were attributed to participation in the program.

The calculated NTGR is about right but could be reduced slightly to 0.0 as the equipment was needed to meet forecasted production needs.

B.3 CASE 3: A COMPUTER MANUFACTURING FACILITY WITH A NTGR OF 0.240

Analysis

This is an 800,000-square-foot industrial facility in PG&E’s territory with an average monthly electric bill of $100,000 to $500,000. The organization has a single location and owns and leases portions of the multiple-building facility but pays the entire electric bill. They had the expertise in house to self-sponsor this chiller project, and the incentive levels put them into Strata 3. We interviewed the manager of projects and construction, who handles all of the project-related paperwork for this project. The measure had been installed and the PIR had been submitted at the time of the interview.

The existing chiller was fully functional but was old and in need of replacement. The company knew about the equipment through a previous installation and heard of the program through PG&E before deciding to install the new chiller. They rated the significance of the LNSPC Program incentive as a 5 on a 0-to-10 scale in their decision to install the chiller. They reported that they probably would have installed a chiller of the same efficiency within the year in absence of the program.

The organization applies long-term investment analysis to energy equipment selection, normally requiring a payback of 3 years or less. They estimated that the incentives would cover 50 percent of the incremental cost of installing the new chiller but were unable to provide payback estimates for the project. They reported that the program was “great support for energy savings,” but required massive amounts of paperwork.

The interviewee does not currently plan on sharing results of the program with others inside or outside the organization, but would if asked. He reported that they now planned to install another chiller of the same type as a result of participating in the program. He said that the LNSPC Program incentive was extremely significant in the decision to install another chiller and commented that a lot of their equipment is getting old. He also said that he was extremely certain about the estimated savings for the project and planned to use the M&V results as justification for further projects. He said the organization would be willing to pay for M&V in absence of a program requirement but estimated they would only be willing to pay 1 percent of the incremental cost of the project.

They have no formal energy-related policies and no changes were made as a result of participating in the program.

The calculated NTGR is about right as they probably would have replaced the chiller soon absence of the program, but hearing about the incentive before deciding to install the chiller prompted them to install immediately.

B.4 CASE 4: A SCHOOL DISTRICT WITH A REPORTED NTGR OF 0.265

Analysis

This is a school district in SCE territory with Strata-3-level incentives. The EESP-sponsored project is a lighting retrofit on several sites, with an average of 150,000 square feet. The district owns all locations and pays an average monthly electric bill between $10,000 and $49,999 at each site. We interviewed the principle administrative analyst, who said, "We've applied for rebates. We hire the contractors, administer program." The DPA had been approved at the time of the interview.

Multiple reasons were given for participating, including needing to add equipment, wanting to reduce energy costs, and to improve measure performance, such as the aesthetics and life cycle. The existing equipment was functioning but with significant problems. The district knew of the equipment from previous installations and heard about the program from SCE after it was decided to install the measures to achieve better lighting levels with reduced energy. The district had prior experience with the EESP used, which was chosen through a request-for-proposal process, using a fee-for-service contract.

They rated the overall value of the EESP services as 0, but the program incentives as a 6 (on a 0-to-10 scale) in their decision to install the lighting measures. The customer reported that they probably would have installed equipment with the same efficiency within the year.

The organization uses long-term investment analysis, requiring an average payback of 6 years. They estimated the program incentives accounted for 5 percent of the incremental costs of installing the measures but were unable to provide payback estimates.

They reported liking the accessibility of funds offered by the program but felt the M&V requirements were too burdensome and ate up funds better used for conservation. Participation in the program is not prompting them to install additional energy-efficiency measures as a result. They reported being extremely certain of the measure's estimated savings and do not expect to use the M&V results to sell other projects within the organization. The reported that the M&V requirements accounted for 1 to 3 percent of the total project cost. They reported valuing M&V enough to pay for it and have an M&V program in place, but not at the "troublesome" levels required by the program.

They do not have specific energy-related policies in place and did not change any practices as result of participation in the program.

The calculated NTGR could be reduced to reflect that the customer heard about the program after deciding to install the measures.

B.5 CASE 5: A PARKING LOT WITH A REPORTED NTGR OF 0.315

Analysis

The customer is a commercial property management company in SDG&E's territory; however, the lighting measures were only installed at one location. The EESP-sponsored project fell into Strata 3. We interviewed the chief engineer who estimated the rebate. The company leases the 500,000-square-foot site but pays the entire electric bill, averaging between $50,000 and $99,999 a month. The equipment had already been installed at the time of the interview.

They reported participating in the LNSPC Program to reduce energy costs and that the existing equipment was fully functioning, but with significant problems. They heard about the equipment through a vendor. They became aware of the program after they starting thinking about installing but before they had decided to install the measures. They reported developing the idea for installing the equipment by themselves, but were convinced by the third party to pursue the installation.

In their decision to install the equipment, they reported the significance of the EESP services as an 8 and the program incentive 0, using a 0-to-10 scale, and that they probably would have installed equipment of the same efficiency within one year.

They use long-term investment analysis for equipment selection, normally requiring a 2-year payback. While the interviewee reported that payback calculations had been made on this project, he was unable to provide any estimates. He reported using a combination of pay-for-service and performance contract with the EESP, but did not provide details.

He reported, that as the property management company, the program helps in making the judgments to do retrofits and makes it "easier to approach the owners … helps sell projects." They were familiar with the measures installed. The interviewee reported that he shared the results of the program informally both within and outside the company, but they do not plan to install additional energy-efficient measures as a result of participation in the program. He reported being extremely certain of the savings estimates for the project and did not plan to use the M&V results to sell further projects. He did not have any estimate of the cost of M&V for the project and stated they would not have been willing to pay for M&V on their own because the savings was obvious due to the nature of the retrofit, “80 Watt vs. 30 Watt with 5 times more light on the floor.”

They do not have specific energy-related policies in place and did not change any practices as result of participation in the program.

The calculated NTGR is about right as they reported being convinced by the EESP to pursue the installation, but once convinced, they probably would have installed the same equipment within 1 year.

B.6 CASE 6: A GROCERY STORE WITH A REPORTED NTGR OF 0.350

Analysis

This Strata-1 (Top10) customer was able to answer survey questions by different measure category. The random selection process resulted in them being selected for both Case 6 and Case 8.

This is a grocery store chain that applied for numerous program measures across all utilities. We interviewed the senior manager of demand-side management for the large commercial customer. This measure took place on multiple sites; the average building size was 40,000 square feet. The company owns and occupies most of theses buildings and pays its own electric bills, which average between $100,000 to $500,000 per month per site. At the time of the interview, the company had five DPAs accepted, combined across all utilities.

The most important reason for participation in the LNSPC program was to save money on energy bills. The company had EESP sponsorship for the program requirements; one company handled the paperwork and developed the efficiency measures, and another implemented the M&V requirements. The respondent’s company learned of the LNSPC Program from an ESCO and knew about the program before they began to think about or decided to install the energy-efficient equipment. The EESP initiated contact with the commercial customer, and they received the ideas for energy-efficiency improvements from this EESP and were also convinced to pursue installation. The grocery chain has worked with the sponsoring EESP before as part of a larger contract and said this about their ongoing relationship, “(The EESP) maintains all energy-related equipment and pays all the energy bills—they guarantee a certain fixed cost for this maintenance and operation capital improvements like these measures are done by mutual consent of the parties for their mutual benefit.”

The participating organization does apply long-term investment analysis for equipment selection. Typically, projects must pay back in 3.25 years. The calculated payback for all of their combined measures without incentives was 3 years. M&V is expected to cost 23 percent of incentive costs, and the DPA/BPA process will cost around 5 percent.

The company will use the results of this program internally and will be applying measures to additional locations in the future. They plan to use the M&V results to sell further energy-efficiency improvements whether or not incentives are available. They will not share their results with any competitor.

The organization has developed some policies for selecting energy-efficient equipment as a result of the program. They plan to include some of these new measures in the routine upgrading of facilities. There is no internal incentive program for energy improvements; it's part of the respondent's job.

The specific measure for Case 6 is for installing anti-sweat heater controls. Since this measure is an addition to existing equipment, there was no replacement of equipment. The customer was greatly influenced by the EESP in their decision to install the package of energy-efficiency measures (8 out of 10), and the LNSPC Program also weighed heavily in their decision to implement the measure, ranking 9 out of 10. Without the program, however, the respondent said they definitely would have installed this measure, and it would have probably been equally as efficient. Installation, however, probably would have been delayed for 6 years.

The respondent was extremely certain of savings estimates before the decision to implement the measure. A measured savings contract between the EESP and the utility had no affect on the customer's confidence in the EESP's estimate of savings. The company estimated that the percent of incremental costs being paid by the program incentive for this measure was 70 percent.

The calculated NTGR could be adjusted up somewhat as the EESP services and incentive were highly significant, but once convinced by the EESP to install the measure, they would have probably installed the measure. However, the installation could have been delayed up to 10 years.

B.7 CASE 7: A LARGE INSTITUTIONAL PROCESSING FACILITY WITH A NTGR OF 0.667

Analysis

The organization planned to install 12 VSDs at separate locations in the SCE territory, with incentive levels in Strata 2. They own all of the sites in this multi-location organization; the sites have an average monthly utility bill under $10,000. The interview was conducted with the preventative maintenance manager, who works with the sponsoring EESP, with which they have a long-term contract, to identify energy-efficiency opportunities. While the BPA had been submitted, the final decision to install had not yet been made at the time of the interview.

They reported participating in the program to obtain the rebate. They installed the VSDs to replace older equipment, reduce energy costs, improve measure performance, and to gain more control over the operation. The existing equipment was fully functional, but had significant problems.

They knew of the equipment from previous installations and heard of the program from their utility before thinking of installing the equipment. They consider themselves to be the sole decision maker for coming up with the idea and deciding to pursue installation of the equipment. The interviewee said, "We have done VFDs in the past, sometimes with SCE rebates, sometimes without. They are good things to have, and we will continue to install them as the capital budget allows; with rebates and incentives, we are able to install more of them and sooner."

As no final decisions had been made regarding the installation, when prompted, the interviewee was unable to provide an estimate of the significance of the EESP involvement or the incentive levels in the decision to install the equipment. However, he said that while they probably would install equipment with the same efficiency, the installations would be delayed up to 10 years in absence of the program.

The organization does not use long-term investment analysis for energy equipment decisions, but the interviewee stated that he often did for his own personal use but was unable to provide any estimate of the payback for the current project. While the he expected to share results of program participation within the organization and that additional energy-efficiency measures would be installed, he said that participation in the program would be somewhat insignificant in the decision to install additional measures. They were very certain of the estimated savings when deciding to install the VSDs, but the M&V requirement did increase their confidence somewhat as well. The interviewee liked the program's incentive and M&V requirement. He said that M&V is "always a good idea" and that his organization would be willing to pay for at least some M&V it in absence of a program requirement to do so.

He reported that the organization has equipment specification policies and reward systems for saving on energy costs, but that these policies were not affected by participation in the program.

The calculated NTGR is about right, in that that they would have installed the measures anyway, but installation would have been delayed up to 10 years.

B.8 CASE 8: A GROCERY STORE CHAIN WITH A REPORTED NTGR OF 0.892

Analysis

As for Case 6, we interviewed the senior manager of demand-side management for the large commercial grocery story chain. The measure for Case 8 is for replacing the existing compressors with new, higher efficiency ones. The existing equipment was fully functional, and without the program, they probably would not have installed the new equipment.

The respondent's company learned of the LNSPC Program from an ESCO, but unlike Case 6, the applicants heard about the technology for energy-efficiency improvements from a previous installation.

The respondent reported that they estimated the percent of incremental costs for this measure being paid by the program incentive as 60 percent. *For more detailed information, refer to Case 6.*

The calculated NTGR is about right as the customer reported that they would probably not have installed any new equipment in absence of the program, even though they were familiar with higher efficiency compressors.

B.9 CASE 9: FINANCIAL INSTITUTION WITH AN NTGR OF 0.892

Analysis

The EESP-sponsored project consisted of several lighting measures on locations throughout the state. The incentives were in Strata 2. The sites are both owned and leased and average 7,500 square feet, with an average monthly electric bill between $10,000 and $49,999. We interviewed a vice president, who was an overall coordinator for the three regions in California. The BPA had been submitted but not yet approved at the time of the interview.

They participated in the program to receive the incentives and installed the equipment to reduce energy costs and improve measure performance. The old equipment was fully functional, but had significant problems. The project is designed to bring the lighting systems of locations acquired from other institutions up to the corporate standard. The customer knew of the equipment through previous installations. The EESP approached them and told them of the LNSPC Program before they thought about installing the equipment. They reported that they got the idea to install from the EESP but decided to pursue installation on their own.

They reported the EESP services had a significance of 5 and the program incentive had a significance of 9, using a 0-to-10-point scale, in their decision to install the measures. They added that the EESP, "Brought the idea of doing them en-masse to leverage the value of the [LNSPC] program." They reported that they probably would not have installed the equipment in absence of the program.

The organization uses long-term investment analysis for energy equipment, normally requiring a 2.5-year payback. He estimated that the incentives covered 20 percent of the incremental costs of the measures but was unable to provide payback estimates. He said that he would share the results of program participation within, but not outside of the organization. He said he wanted to see the results of this project before deciding whether additional measures would be installed as a result of program participation. He reported being somewhat uncertain of the estimated savings when deciding to install, and that the M&V requirement for the EESP had some effect on increasing his confidence. He estimated that the M&V costs were going to represent 35 percent of the incentives. He felt that the organization would probably pay for some M&V in absence of program requirement, or at least verification of installation, but was unable to give a cost estimate.

The organization has specification policies for equipment, but no changes to that or other policies have been made as a result of program participation.

The calculated NTGR is about right and could perhaps be raised slightly as the customer found both the EESP services and program incentives important in their decision and probably would not have installed the equipment in absence of the program.

B.10 CASE 10: AN INDUSTRIAL CUSTOMER WITH A NTGR OF 0.917

Analysis

This is a self-sponsored project for an industrial customer in SCE's territory with Strata-3-level incentives. It is a multi-site research facility of approximately 165,000 square feet, which the company owns and occupies. Their average monthly electric bill is between $100,000 and $500,000. The measure includes upgrading two existing and fully functioning chillers and "changing wheels" on them. At the time of the interview, the project's DPA had been accepted. We interviewed the director of facilities at this site.

The customer is a self-sponsor (saying it was less costly to do it themselves) that used the chiller manufacturer to help them with the M&V requirements. They selected the manufacturer because of the product line and received a fee-for-service/equipment contract for the work. This measure was developed by ideas from a previous installation. The interviewee said that they developed the measure idea themselves and decided to pursue installation on their own. They wanted to reduce their energy costs, so they approached the utility representative. At that point they were informed of the LNSPC Program and learned of the incentive money.

The respondent said that overall, the services provided by the sponsoring firm were significant in their decision to install the equipment, ranking 8 out of 10. This firm helped them with the M&V and evaluating the savings associated with the measure. He also said that the LNSPC incentive was extremely significant in their decision to implement the energy-efficient equipment, rating it a 10 out of 10. He figured that the program paid about 50 percent of the incremental costs of implementing the high-efficiency measure. Without the incentive, he added, they probably would not have installed anything.

The company does apply payback analysis to energy improvements but said that it depends on the project type as to how long the payback period can be. For this measure, he calculated that payback would be less than 3 years with the incentive.

The respondent liked the incentive money for energy-efficiency measures but disliked the paperwork and slow process that the program entailed. He thought the payment procedures and timing for payment were reasonable, however. It was too early to tell how satisfied they were with the energy-efficiency measures, but they were extremely certain of the energy savings associated with the chiller upgrades when they decided to implement them.

They plan to share results of this program internally–informally–but will not share outside their organization. They do not plan to implement any additional energy-efficiency measures as a result of their participation in the program.

The organization has a reward program for saving energy internally, and the rewards are based on management's determination of how valuable the measure was. This system was not changed as a result of the program.

The calculated NTGR is about right as the customer said that both the EESP services and program were very significant and that they probably would not have installed anything in absence of the program. However, they were proactive in seeking out incentives from the utility.

C

FILED EVALUATION STUDIES FOR PROGRAMS IMPLEMENTED IN 1994-1998

Appendix C provides a list of evaluation studies, filed with the CPUC, of DSM programs implemented from 1994 through 1998 by the four investor-owned utilities in California (PG&E, SCE, SDG&E, and SoCal Gas). Provided for each study are the:

1 sponsoring utility
2 program year (PY) of the DSM program being evaluated
3 study ID, which is a unique identifier assigned by the CPUC
4 type of net-to-gross ratio technique used in the study:
   a. LR=Load Impact Regression Model
   b. DC=Discrete-Choice
   c. SR=Self-Report
5 title of the study
6 date of completion, and
7 study author.

Note that PDF versions of many of these studies can be found on the CALMAC website: http://www.calmac.org/search.asp and downloaded. Those studies that are not available from this website can be requested from the California Energy Commission.

Utility	PY	StudyID	NTG Analysis Type	Study Title	Study Date	Study Author
PG&E	1994	310	SR	Impact Evaluation of 1994 Commercial Lighting Technologies Study	27-Feb-96	Quantum Consulting Inc
PG&E	1994	311	SR	Impact Evaluation of 1994 Industrial Lighting Technologies Study	27-Feb-96	Quantum Consulting Inc
PG&E	1994	312	LR	1994 Commercial HVAC Impact Evaluation	01-Mar-96	SBW Consulting Inc., KVDR, Inc., Ridge and Associa
PG&E	1994	313	SR	Impact Evaluation of the Industrial HVAC End Use in PG&E's 1994 Retrofit Energy-Efficiency Programs	28-Feb-96	XENERGY Inc.
PG&E	1994	314	SR	Impact Evaluation of 1994 Industrial Process Energy-Efficiency Projects	01-Mar-96	XENERGY Inc.
PG&E	1994	315	SR	Impact Evaluation of PG&E's 1994 Agricultural Programs	27-Feb-96	Quantum Consulting Inc
PG&E	1994	316	SR	Impact Evaluation of PG&E's 1994 Commercial-Industrial Energy Management Services Programs: Commercial EMS	26-Feb-96	Hagler Bailly Consulting, Inc. and ADM Associates
PG&E	1994	317	SR	Impact Evaluation of PG&E's 1994 Commercial-Industrial Energy Management Services Programs: Industrial EMS	26-Feb-96	Hagler Bailly Consulting, Inc. and ADM Associates
PG&E	1994	318	SR	Impact Evaluation of PG&E's 1994 Agricultural Programs	27-Feb-96	Quantum Consulting Inc
PG&E	1994	320	NA	Impact Evaluation of 1994 Industrial Miscellaneous Measures Energy-Efficiency Projects	01-Mar-96	XENERGY Inc.
PG&E	1994	321	SR	Impact Evaluation of PG&E's 1994 Agricultural Programs	27-Feb-96	Quantum Consulting Inc

Utility	PY	StudyID	NTG Analysis Type	Study Title	Study Date	Study Author
PG&E	1994	323	LR	Pacific Gas and Electric Company and Southern California Edison 1994 Nonresidential New Construction Programs	01-Mar-97	RLW Analytics, Inc.
PG&E	1994	332	NA	Impact Evaluation of Pacific Gas and Electric Company's 1994 Residential Appliance Efficiency Incentives and 1994 Residential Weatherization Retrofit Incentives Programs	28-Feb-97	XENERGY, Inc.
PG&E	1994	384A	NA	Impact Evaluation of Pacific Gas and Electric Company's 1994 Residential Appliance Efficiency Incentives and 1994 Residential Weatherization Retrofit Incentives Programs	28-Feb-97	XENERGY, Inc.
PG&E	1994	384B	NA	Impact Evaluation of Pacific Gas and Electric Company's 1994 Residential Appliance Efficiency Incentives and 1994 Residential Weatherization Retrofit Incentives Programs	28-Feb-97	XENERGY, Inc.
PG&E	1994	384C	NA	Impact Evaluation of Pacific Gas and Electric Company's 1994 Residential Appliance Efficiency Incentives and 1994 Residential Weatherization Retrofit Incentives Programs	28-Feb-97	XENERGY, Inc.
PG&E	1995	324	SR, DC	Evaluation of Pacific Gas & Electric Company's 1995 Nonresidential Energy Efficiency Incentives Program for Commercial Sector Lighting Technologies	01-Mar-97	Quantum Consulting Inc
PG&E	1995	325	SR	Impact Evaluation of 1995 Industrial Sector Energy Efficiency Incentives Programs: Lighting	01-Mar-97	SBW Consulting Inc. and Ridge and Associates

Utility	PY	StudyID	NTG Analysis Type	Study Title	Study Date	Study Author
PG&E	1995	326	SR	Evaluation of Pacific Gas & Electric Company's 1995 Nonresidential Energy Efficiency Incentives Program for Commercial Sector HVAC Technologies	01-Mar-97	Quantum Consulting Inc
PG&E	1995	327	SR	Impact Evaluation of 1995 Industrial Sector Energy Efficiency Incentives Programs: HVAC	01-Mar-97	SBW Consulting Inc. and Ridge and Associates
PG&E	1995	328	SR	Impact Evaluation of 1995 Industrial Sector Energy Efficiency Incentives Programs: Process	01-Mar-97	SBW Consulting Inc. and Ridge and Associates
PG&E	1995	329	SR	Impact Evaluation of PG&E's 1995 Agricultural EEI Programs	01-Mar-97	Quantum Consulting Inc
PG&E	1995	330	SR	Evaluation of Pacific Gas & Electric Company's 1995 Nonresidential Energy Efficiency Incentives Program for Commercial Sector Refrigeration Technologies	01-Mar-97	Quantum Consulting Inc
PG&E	1995	331	SR	Impact Evaluation of PG&E's 1995 Agricultural EEI Programs	01-Mar-97	Quantum Consulting Inc
PG&E	1995	336	LR	Impact Evaluation of Pacific Gas and Electric Company's 1995 Residential Direct Assistance and 1995 Residential Energy Management Services Programs	01-Mar-97	XENERGY, Inc.
PG&E	1995	337	LR	Impact Evaluation of Pacific Gas and Electric Company's 1995 Residential Direct Assistance and 1995 Residential Energy Management Services Programs	01-Mar-97	XENERGY, Inc.
PG&E	1996	349	DC	Evaluation of PG&E's 1996 Nonresidential EEI Program for Commercial Sector Lighting Technologies	01-Mar-98	Quantum Consulting Inc
PG&E	1996	350	SR	Impact Evaluation of 1996 Industrial Sector Energy Efficiency Incentives Programs: Lighting	01-Mar-98	SBW Consulting Inc. and KVDR, Inc.

Utility	PY	StudyID	NTG Analysis Type	Study Title	Study Date	Study Author
PG&E	1996	351	SR, DC	Impact Evaluation of Pacific Gas & Electric Company's 1996 Commercial Energy Efficiency Incentives Program: HVAC Technologies	01-Mar-98	Quantum Consulting Inc
PG&E	1996	352	SR	Impact Evaluation of 1996 Industrial Sector Energy Efficiency Incentives Programs: HVAC	01-Mar-98	SBW Consulting Inc. and KVDR, Inc.
PG&E	1996	353	SR	Impact Evaluation of 1996 Industrial Sector Energy Efficiency Incentives Programs: Process	01-Mar-98	SBW Consulting Inc. and KVDR, Inc.
PG&E	1996	354	DC	Impact Evaluation of PG&E's 1996 Agricultural EEI Program	01-Mar-98	Equipoise Consulting Inc.
PG&E	1996	358	SR	Impact Evaluation of 1996 Commercial Sector Energy Management Services Program	01-Mar-98	Quantum Consulting Inc
PG&E	1996	359	SR	Impact Evaluation of Pacific Gas & Electric Company's 1996 Industrial Sector Energy Management Services Program	01-Mar-98	SBW Consulting Inc. and KVDR, Inc.
PG&E	1996	360	NA	Impact Evaluation of PG&E's 1996 Agricultural EMS Program	01-Mar-98	Equipoise Consulting Inc.
PG&E	1996	372	SR	Impact Evaluation of Pacific Gas and Electric Company's 1996 Residential Appliance Efficiency Incentives Program	01-Mar-98	XENERGY, Inc.
PG&E	1996	373-1	SR	Impact Evaluation of Pacific Gas and Electric Company's 1996 Residential Appliance Efficiency Incentives Program	01-Mar-98	XENERGY, Inc.
PG&E	1996	385	DC	Impact Evaluation of PG&E's 1996 Agricultural EEI Program	01-Mar-98	Equipoise Consulting Inc.
PG&E	1996	389	LR	Pacific Gas and Electric Company's 1996 Nonresidential New Construction Programs	01-Mar-98	RLW Analytics, Inc.

Utility	PY	StudyID	NTG Analysis Type	Study Title	Study Date	Study Author
PG&E	1997	333A	DC	Evaluation of Pacific Gas & Electric Company's 1997 Commercial Energy Efficiency Incentives Program: Lighting Technologies	01-Mar-99	Quantum Consulting Inc
PG&E	1997	333B	SR, DC	Evaluation of PG&E's 1997 Commercial EEI Program HVAC Technologies	01-Mar-99	Quantum Consulting Inc
PG&E	1997	334A	SR	1997 Industrial Energy Efficiency Incentive Program Impact Evaluation: Process End Use	01-Mar-99	XENERGY Inc.
PG&E	1997	334B	SR	1997 Industrial Energy Efficiency Incentive Program Impact Evaluation: Indoor Lighting End Use	01-Mar-99	XENERGY Inc.
PG&E	1997	335A	NA	Impact Evaluation of PG&E's 1997 Agricultural EEI Program	01-Mar-99	Equipoise Consulting Inc.
PG&E	1997	335B	NA	Impact Evaluation of PG&E's 1997 Agricultural EEI Program	01-Mar-99	Equipoise Consulting Inc.
PG&E	1997	335C	NA	Impact Evaluation of PG&E's 1997 Agricultural EEI Program	01-Mar-99	Equipoise Consulting Inc.
PG&E	1997	397	SR	Impact Evaluation of Pacific Gas and Electric Company's 1997 Residential Energy Management Services Programs	01-Mar-99	Hagler Bailly Consulting and XENERGY Inc.
PG&E	Pre-1998	403A	SR	Pre-1998 Industrial Energy Efficiency Incentive Program 1998 Carry Over Impact Evaluation	01-Mar-00	XENERGY Inc.
PG&E	Pre-1998	403B	SR	Pre-1998 Industrial Energy Efficiency Incentive Program 1998 Carry Over Impact Evaluation	01-Mar-00	XENERGY Inc.
PG&E	Pre-1998	403C	SR	Pre-1998 Industrial Energy Efficiency Incentive Program 1998 Carry Over Impact Evaluation	01-Mar-00	XENERGY Inc.
PG&E	Pre-1998	404A	DC	Evaluation of PG&E's Pre-1998 Commercial EEI Program Carry-over Lighting Technologies	01-Mar-00	Quantum Consulting Inc

Utility	PY	StudyID	NTG Analysis Type	Study Title	Study Date	Study Author
PG&E	Pre-1998	404B	SR	Evaluation of PG&E's Pre-1998 Commercial EEI Program Carry-over HVAC Technologies	01-Mar-00	Quantum Consulting Inc
PG&E	Pre-1998	404C	SR	Pre-1998 Commercial Energy Efficiency Incentive Program 1998 Carry over Impact Evaluation	01-Mar-00	XENERGY Inc.
PG&E	Pre-1998	404D	SR	Evaluation of PG&E's Pre-1998 Commercial EEI Program Carry-over Traffic Signal Technologies	01-Mar-00	Quantum Consulting Inc
PG&E	Pre-1998	405A	NA	Pacific Gas and Electric Company's Carryover for Pre-1998 Energy Efficiency Incentives Program: Agricultural Sector Impact Evaluation Report	01-Mar-00	Equipoise Consulting Inc.
PG&E	Pre-1998	405B	NA	Pacific Gas and Electric Company's Carryover for Pre-1998 Energy Efficiency Incentives Program: Agricultural Sector Impact Evaluation Report	01-Mar-00	Equipoise Consulting Inc.
PG&E	Pre-1998	405C	NA	Pacific Gas and Electric Company's Carryover for Pre-1998 Energy Efficiency Incentives Program: Agricultural Sector Impact Evaluation Report	01-Mar-00	Equipoise Consulting Inc.
PG&E	Pre-1998	400	DD, SR	Pre-1998 Nonresidential New Construction Impact Evaluation Carryover	01-Mar-00	RLW Analytics, Inc.
SCE	1994	512	LS	1994 Residential HVAC Rebate Program Impact Evaluation	01-Feb-96	XENERGY, Inc.
SCE	1994	513	DD	Residential Appliance Efficiency Incentives Program: Fluorescent Lighting (CFL): 1994 First-Year Statewide Load Impact Study	01-Feb-96	XENERGY, Inc.
SCE	1994	514	DD	Residential Appliance Efficiency Incentives Program: High Efficiency Refrigeration: 1994 First-Year Statewide Load Impact Study	01-Feb-96	XENERGY, Inc.

Utility	PY	StudyID	NTG Analysis Type	Study Title	Study Date	Study Author
SCE	1994	515	SR	Extended Impact Evaluation of the Spare Refrigerator Recycling Program	01-Feb-97	XENERGY, Inc.
SCE	1994	516	LS	Evaluation of First-Year Load Impacts of Southern California Edison's 1994 Commercial Energy Efficiency Incentives and Audit Programs	01-Mar-96	Synergic Resources Corporation, Kirtida Parikh, Ap
SCE	1994	517	SR	First-Year Impact Studies: 1994 Industrial Services and Retrofit Incentive Programs	01-Feb-96	Alternative Energy Systems Consulting, Inc.
SCE	1994	518A	SR	Evaluation of First-Year Load Impacts of Southern California Edison's 1994 Agricultural Audit and Rebate Programs	01-Feb-96	Athens Research
SCE	1994	518B	SR	Evaluation of First-Year Load Impacts of Southern California Edison's 1994 Agricultural Audit and Rebate Programs	01-Feb-96	Athens Research
SCE	1994	519	LS	Evaluation of First-Year Load Impacts of Southern California Edison's 1994 Commercial Energy Efficiency Incentives and Audit Programs	01-Mar-96	Synergic Resources Corporation, Kirtida Parikh, Ap
SCE	1994	520	SR	First-Year Impact Studies: 1994 Industrial Services and Retrofit Incentive Programs	01-Feb-96	Alternative Energy Systems Consulting, Inc.
SCE	1994	522	LR	Impact Evaluation of Pacific Gas & Electric Company and Southern California Edison 1994 Nonresidential New Construction Programs	01-Mar-97	RLW Analytics, Inc.
SCE	1994	561	NA	1994 Commercial CFL Evaluation: First-Year Impact Evaluation	01-Feb-96	Decision Sciences Research Associates, Inc.
SCE	1995	527	SR	Impact Evaluation of the 1995 Residential Direct Assistance Program	01-Feb-97	XENERGY, Inc.
SCE	1995	528A	LR	1995 In-Home Audit Program Evaluation	01-Feb-97	RER

Utility	PY	StudyID	NTG Analysis Type	Study Title	Study Date	Study Author
SCE	1996	537	SR	Final Report: Impact Evaluation of the Spare Refrigerator Recycling Program	01-Apr-98	XENERGY, Inc.
SCE	1996	539	SR	Southern California Edison 1996 DSM Bidding Program Evaluation	01-Apr-98	Ridge & Associates
SCE	1996	540	DD	1996 Commercial Energy Management Hardware Rebate Program Impact Evaluation	01-Mar-98	RER
SCE	1996	541	SR	1996 Industrial Energy Efficiency Incentive Program Impact Study	01-Mar-98	Alternative Energy Systems Consulting, Inc. & Ridg
SCE	1996	542	SR	1996 Agricultural/Water Supply Energy Efficiency Incentive Program: First-Year Load Impacts Evaluation	01-Feb-98	HDR Engineering, Inc.
SCE	1996	543	LR	Southern California Edison 1996 Non-Residential New Construction Evaluation	01-Feb-98	RLW Analytics, Inc.
SCE	1996	544	LR	Southern California Edison 1996 Commercial Energy Services Program: Load Impact Evaluation	01-Mar-98	Athens Research
SCE	1997	566	SR	1997 DSM Bidding Program Impact Study	01-Feb-99	Ridge & Associates
SCE	1997	567	DC	1997 Commercial Energy Efficiency Incentive Program Evaluation	01-Mar-99	RER
SCE	1997	568	SR	1997 Industrial Energy Efficiency Incentive Program Impact Study	01-Feb-99	Alternative Energy Systems Consulting, Inc. & Ridg
SCE	1997	569	SR	1997 Agricultural Efficiency Incentive Program Impact Study	01-Feb-99	Alternative Energy Systems Consulting, Inc. & Ridg
SCE	1998	5000	SR	Evaluation of the 1998 Nonresidential Standard Performance Contract Program	01-May-99	XENERGY, Inc.
SCE	1998	572	DD	Southern California Edison Pre-1998 Non-Residential New Construction Evaluation	01-Dec-99	RLW Analytics, Inc.

Utility	PY	StudyID	NTG Analysis Type	Study Title	Study Date	Study Author
SDG&E	1994	920	DD	Residential Appliance Efficiency Incentives Program--High Efficiency Lighting--1994 First Year Statewide Load Impact Study	01-Feb-96	Xenergy
SDG&E	1994	923	DD	1994 Commercial Energy Efficiency Incentives Program--First Year Load Impact Evaluation and Retention Studies	01-Feb-96	SDG&E/Xenergy
SDG&E	1994	926	DD	1994 Industrial Energy Efficiency Incentives Program--First Year Load Impact Evaluation and Retention Studies	01-Feb-96	SDG&E/Xenergy
SDG&E	1994	929	NA	1994 Agricultural Energy Efficiency Incentives Program--Miscellaneous Measures--First Year Retention Study	01-Feb-96	Xenergy
SDG&E	1994	932	DD	1994 Residential New Construction Program--First Year Load Impact Evaluation	01-Feb-96	SDG&E
SDG&E	1994	935	DD	1994 Nonresidential New Construction Program--First Year Load Impact Evaluation	01-Feb-96	SDG&E
SDG&E	1995	959	DD	1995 Commercial Energy Efficiency Incentives Program--First Year Load Impact Evaluation	01-Feb-97	SDG&E/Xenergy
SDG&E	1995	962	DD	1995 Industrial Energy Efficiency Incentives Program--First Year Load Impact Evaluation	01-Feb-97	SDG&E/Xenergy
SDG&E	1995	965	NA	1995 Agricultural Energy Efficiency Incentives Program--First Year Load Impact Evaluation	01-Jan-97	Xenergy
SDG&E	1995	971	DC	1995 Nonresidential New Construction Program--First Year Load Impact Evaluation	01-Mar-97	RER
SDG&E	1996	1001		1996 Residential New Construction Program--First Year Load Impact Evaluation	01-Mar-98	Not Available

Utility	PY	StudyID	NTG Analysis Type	Study Title	Study Date	Study Author
SDG&E	1996	1004	DC	1996 Nonresidential New Construction Program--First Year Load Impact Evaluation	01-Feb-98	RER
SDG&E	1996	980	DD	Residential Appliance Efficiency Incentives Program: High Efficiency Refrigeration--1996 First Year Statewide Load Impact Study--Net-To-Gross Analysis	01-Feb-98	Hagler Bailly
SDG&E	1996	983	SR	1996 Residential Appliance Efficiency Incentives Program--High Efficiency Lighting--First Year Load Impact Evaluation	01-Mar-98	SDG&E/Hagler Bailly
SDG&E	1996	989	DD	1996 Residential Weatherization Retrofit Incentives--First Year Load Impact Evaluation	01-Mar-98	SDG&E
SDG&E	1996	992	DD	1996 Commercial Energy Efficiency Incentives Program--First Year Load Impact Evaluation	01-Mar-98	SDG&E/Xenergy
SDG&E	1996	995	SR	1996 Industrial Energy Efficiency Incentives Program--First Year Load Impact Evaluation--Final Report	01-Feb-98	Xenergy
SDG&E	1996	998	NA	1996 Agricultural Energy Efficiency Incentives Program--First Year Load Impact Evaluation--Final Report	01-Feb-98	Xenergy
SDG&E	1997	1025	LR	1997 Commercial Energy Efficiency Incentives Program--First Year Load Impact Evaluation--Final Report	01-Feb-99	Xenergy
SDG&E	1997	1019	SR	1997 Industrial Energy Efficiency Incentives Program--First Year Load Impact Evaluation--Final Report	01-Feb-99	Xenergy
SDG&E	1997	1022	NA	1997 Agricultural Energy Efficiency Incentives Program--First Year Load Impact Evaluation--Final Report	01-Feb-99	Xenergy

Utility	PY	StudyID	NTG Analysis Type	Study Title	Study Date	Study Author
SoCalGas	1994	703	LR	First Year Load Impact Study of Southern California Gas Company's 1994 Direct Assistance Program	2/1/96	Not Available
SoCalGas	1994	708	LR	First Year Load Imp Study of Southern California Gas Company's 1994 Home Energy Fitness Program	2/1/96	Not Available
SoCalGas	1994	709	LR	First Year Impact Study of Southern California Gas Company's 1994 Advantage Home Program	3/1/97	Not Available
SoCalGas	1995	705	DC	An Evaluation of Southern California Gas Company's 1995 Commercial New Construction Program	31-Jan-98	Planergy, Inc., Equipoise Consulting, and Pacific Consulting Services
SoCalGas	1995	710	LR	First Year Load Impact Study of Southern California Gas Company's 1995 Industrial Energy Management Services	28-Feb-97	Business Economic Analysis and Research and Mykytyn Consulting Group, Inc.
SoCalGas	1996	711	DD	First Year Load Impact Study of Southern California Gas Company's Program Year 1996 Commercial Energy Efficiency Incentive Program	28-Feb-98	Applied Econometrics, Inc. and Decision Sciences Research Associates
SoCalGas	1996	712	LR	First Year Load Impact Study of Southern California Gas Company's 1996 Commercial Energy Management Services	28-Feb-98	Business Economic Analysis and Research and Mykytyn Consulting Group, Inc.
SoCalGas	1997	714	LR	First Year Load Impact Study of Residential Energy Efficiency Program (DSM Pilot Bidding Program)	01-Apr-99	Energx Controls Inc.
SoCalGas	1997	715	LR	1997 Residential Energy Management Services First Year Load Impact Evaluation (Home Energy Fitness Program)	01-Mar-99	AAG & Associates

D

QUESTIONS AND ALGORITHMS USED IN CALCULATING ALTERNATE NTGRS

We conducted an analysis to determine how sensitive the NTGRs were to the inclusion of specific questions, linear and non-linear transformations of scales, and the use of various weighting schemes. We created nine additional NTGRs that reflected these systematic modifications. The series of questions related to the decision making process that provided the raw materials for calculating the NTGR are listed below. the formula for the nine additional NTGRs are at the end of this appendix.

PROGRAM-RELATED DECISION MAKING SECTION - NET-TO-GROSS

[INFORM THE INTERVIEWEE THAT THE FOLLOWING QUESTIONS PERTAIN TO THE PARTICULAR ENERGY EFFICIENCY MEASURES THAT ARE TO BE INSTALLED AS PART OF THE 1999 LNSPC PROGRAM. ASK THEM TO LET YOU KNOW IF THE RESPONSES VARY BY MEASURE. USE MULTIPLE FORMS IF ANSWERS APPEAR TO VARY SIGNIFICANTLY BY MEASURE OR PROJECT TYPE FOR THIS SECTION.]

PD1a Why did you decide to install ***Program-Related Equipment***? [DO NOT READ]

Needed to replace older equipment 1
Needed to add equipment because of a remodel, build-out, or expansion 2
Wanted to reduce our energy costs 3
Wanted more control over how the equipment was used. 4
Wanted to improve measure performance...5
Don't Know/Refused...6
Other__________ PD1a1. Describe____________________________7

[DESCRIBE AS NEEDED]____

____

PD1b Which of the following statements best describes the performance and operating condition of the equipment you replaced as part of the 1999 program?

New equipment installed, did NOT replace pre-existing equipment 1
Existing equipment was fully functional 2
Existing equipment was fully functioning, but with significant problems............3
Or, existing equipment had failed or did not function..4
Don't Know/Refused...98
Other__________ PD1b1. Describe____________________________7

PD 2 If this is the first time you're installing ***Energy Efficiency Equipment,*** where did you first hear about it?

[READ ONLY AS NEEDED]

1 Contractor

2 Architect / Engineer

3 Equipment Vendor

4a *PG&E representative or program literature (confirm, regulated distribution company)*

4b SCE representative or program literature (confirm, regulated distribution company)

4c SDG&E representative *or program literature (confirm, regulated distribution company)*

5 Other non-utility literature, including trade publications

6 Self knowledge/Education

7 Business colleague / Professional association / Tradeshow

8 From parent company

9 **Previous installation**

10 Energy Services Company, often referred to as ESCOs

11 An unregulated company that provides electricity supply

12 Energy Efficiency Program (non-utility)

11 OTHER **[SPECIFY, OK TO PUT NAME OF COMPANY]**

____

12 DON'T KNOW / REFUSED

PD3 How did you first learn of the LNSPC Program? [DONT READ; PROBE IF SAME SOURCE AS PD2]

Specify name of company/source:____

CIRCLE CLOSEST CATEGORY

1 Contractor

2 Architect / Engineer

3 Equipment Vendor

4a *PG&E representative or program literature (confirm, regulated distribution company)*

4b SCE representative or program literature (confirm, regulated distribution company)

4c SDG&E representative *or program literature (confirm, regulated distribution company)*

5 Other non-utility literature, including trade publications

6 Self knowledge/Education

7 Business colleague / Professional association / Tradeshow

8 From parent company

9 Previous installation

10 Energy Services Company, often referred to as ESCOs

11 An unregulated company that provides electricity supply

12 Energy Efficiency Program (non-utility)

11 OTHER **[SPECIFY, OK TO PUT NAME OF COMPANY]**

____

12 DON'T KNOW / REFUSED

PD 4a When did you first learn about the LNSPC Program? Was it **BEFORE** or **AFTER** you <u>decided to install</u> the ***Energy Efficient Equipment*** that you plan to install?

1 BEFORE

2 SAME TIME SKIP TO PD4c

3 AFTER SKIP TO PD4c

9 DON'T KNOW / REFUSED

PD 4b Was it **BEFORE** or was it **AFTER** you first began <u>to think about installing</u> ***Energy Efficient Equipment***?

1 BEFORE

2 SAME TIME

3 AFTER

9 DON'T KNOW / REFUSED

PD4c Which of the following best describes the process by which you decided to install the ***Energy Efficiency Equipment?***

1 Developed the idea ourselves and decided solely on our own to pursue installation

2 Developed the idea ourselves but were convinced by a third-party to pursue installation

3 Received the idea from a third-party and were also convinced by this party to pursue installation

4 Received the idea from a third-party but decided on our own to pursue installation

5 Other ➨PD4c1. Describe____

9 DON'T KNOW / REFUSED

[RECORD ANY EXPLANATORY COMMENTS]

____

____

****IF SELF-SPONSOR DOING ALL WORK THEMSELVES, SKIP TO PD6c,**
IF SELF SPONSOR WITH EESP HELP, SKIP TO PD6a, ELSE CONTINUE**

PD4d. Who initiated contact? Did **SPONSOR** approach you or did you approach them to discuss installing the ***Energy Efficiency Equipment?***

1 Customer initiated contact

2 EESP initiated contact

3 Other ➨PD4d1. Describe____

9 DON'T KNOW / REFUSED

PD5 As part of your participation in the LNSPC program, the Energy Efficiency Service Provider that is the sponsor of the program application for your organization will receive an incentive from **UTILITY** payable over two years that is based on the level of energy savings demonstrated to result from your project.

PD5a. Prior to this call, were you aware that incentives will be received by **SPONSOR,** from the LNSPC program for this project?

Yes 1
No............2

PD5b. Which of the following statements best describes the arrangement you have with **SPONSOR** with respect to allocation of the incentives from the LNSPC program? [READ LIST AND SELECT ONLY ONE]

Program incentives will be used by your organization 1
Program incentives will be used by your LNSPC Project Sponsor.......... 2
Program incentives will be split between your organization and your LNSPC Project Sponsor, or you are receiving a reduced fee?....... 3
Other ______________________ 4
Don't know.......... 98
Refused 99

PD6a. How significant was the overall value of the services provided by **SPONSOR/FIRM** in influencing your decision to install the ***Energy Efficiency Equipment***? On a scale from 0 to 10 where 0 is not significant at all and 10 is extremely significant, how significant would you say **SPONSOR/FIRM** was ...

[RECORD PD6a and PD6b BY MEASURE OR END USE IF NEEDED]

_________[0-10, DK]

PD6b. Please describe the specific ways in which **SPONSOR/FIRM** contributed, if at all, to your decision to install the ***Energy Efficient Equipment***?

____

____

____

PD6c. How significant was the LNSPC program incentive in influencing your decision to install the ***Energy Efficiency Equipment***? On a scale from 0 to 10 where 0 is not significant at all and 10 is extremely significant, how significant would you say the program incentive was ...**]**

_________[0-10, DK]

PD7a. Without the LNSPC program, [**READ NEXT CLAUSE FOR CUSTS WORKING WITH 3rd PARTY FIRMS**:] including both the incentive **and** the contribution from **SPONSOR/FIRM,** how likely is it you would have installed the ***Energy Efficient Equipment***? Would you…

1	Definitely would NOT have installed	SKIP TO PD 9a
2	Probably would NOT have installed	SKIP TO PD 9a
3	Probably would have installed	
4	Definitely would have installed	
9	DON'T KNOW / REFUSED	

PD 8 Without the LNSPC program, how likely is it that the equipment you purchased would have been *as energy efficient* as the equipment you installed with the incentive? Would you say . . .

1 Probably NOT as efficient

2 Probably as efficient

3 Not applicable for measure (e.g. VSD)

9 DON'T KNOW / REFUSED

PD 8b Without the LNSPC program, would you have installed the ***Energy Efficient Equipment*** at about the same time as currently planned or over a year later? [If over 1 year later, probe for best estimate of how many years later.]

1 Same Time To Less Than 1 Year __SKIP TO PD10

2 Over 1 Year Later PD8c. Approximately how many years later? __SKIP TO PD10a

9 DON'T KNOW / REFUSED

PD 9a Without the LNSPC program, , [**READ NEXT CLAUSE FOR CUSTS WORKING WITH 3rd PARTY FIRMS**:] including both the incentive **and** the contribution from **SPONSOR**, what type of equipment would you have most likely installed? Would you say. . .

1 Standard efficiency equipment

2 Equipment with above-standard efficiency but with lower efficiency than the equipment that was actually installed

3 Would not have installed anything

9 DON'T KNOW / REFUSED

PD 9b Would you have installed the ***Energy Efficient Equipment*** at a later date? (How many years later)

[If over 1 year later, probe for best estimate of how many years later.]

1 Same Time To Less Than 1 Year

2 Over 1 Year Later PD9c. Approximately how many years later? ____________

9 DON'T KNOW / REFUSED

PD10a. Does your organization apply long-term investment analysis to energy equipment selection such as estimates of payback periods, life cycle costs or internal rate of return?

Yes 1

No 2 SKIP TO PD11

Don't Know/Refused 99 SKIP TO PD11

PD10b. And, typically, how many years or less must the project payback be? _________ Years

[**TRY TO FORCE ANSWER IN PAYBACK TERMS EVEN IF IRR OR LCC USED**]

PD 11 Approximately what percent of the incremental costs of the high-efficiency measures you are implementing as part of the 1999 LNSPC would you estimate are being paid for by the program incentive payments?

ADD MORE LINES IF NEEDED BY MEASURE OR END USE

[CLARIFY: INCLUDING ALL INCENTIVES OVER 3 YEAR PERIOD, E.G., ORIGINAL INCENTIVE LEVELS OF 5.5 cents/kWh saved lighting, 16.5 cents/kWh saved HVAC&R, and 8.0 cents/kWh saved Other]

% of Incremental Cost Paid ________
Don't Know/Refused_______

[**CODE AS DON'T KNOW IF CANT GIVE WITHOUT CALCULATING]**

PD 12a. Have you calculated the payback(s) or used other 'financials' for these projects?

Yes	1	
No	2	SKIP TO P1
Don't Know/Refused	99	SKIP TO P1

PD 12b. And what do you estimate the payback(s) would have been with OR without the incentives?

ADD MORE LINES IF NEEDED BY MEASURE OR END USE

12.b.1 Payback with Incentives ______

12.b.2 Payback without Incentives ______

Don't Know/Refused_______

[CODE AS DON'T KNOW IF CANT GIVE WITHOUT CALCULATING]

ESTABLISHMENT CHARACTERISTICS

EC3. Does your organization.....

Own and occupy	1	SKIP TO EC5
Lease from others	2	
Other	3	
Don't Know	98	SKIP TO EC5
Refused	99	SKIP TO EC5

EC4 (For these participating facilities,) does your organization pay its own electric bill directly to [PACIFIC GAS & ELECTRIC/ SOUTHERN CALIFORNIA EDISON / SAN DIEGO GAS & ELECTRIC] or is electricity provided by the owner under your lease arrangement?

Pay own electric bill	1
Part of the lease arrangement	2
Some sites pay own bill, other sites part of lease	3

[ACCEPT EC4=3 ABOVE ONLY IF RI2=2]

EC5 [IF SINGLE-SITE PARTICIPANT (RI2=1) ASK]
What is your best estimate of your average monthly electric bill **at this facility**?

[ELSE IF MULTI-SITE (RI2=2), ASK]
What is your best estimate of your **average** monthly total electric bill across **all participating sites**? Would you say it is...

- < $10,000 1
- $10,000 - $49,999 2
- $50,000 - $99,999 3
- 100,000 - $500,000 4
- > $500,000 5
  - Don't know 98
  - Refused 99

EC6. What kind of organization is this? Is there a single site, or are there multiple sites?

- Single site 1
- Multiple sites 2
- Don't Know 98
- Refused 99

ENERGY-RELATED DECISION MAKING

Now I'd like to ask some questions about how your organization generally makes energy-related decisions.

DM1a. Has your organization developed any (specification) policies for the selection of energy-efficient equipment?

- Yes 1
- No... 2 SKIP TO DM2
- Don't Know/Refused... 3 SKIP TO DM2

ALTERNATE NTGR CALCULATIONS

The calculation of each of the nine NTGRs is presented in Table D-1.

Table D-1. Algorithms for Calculating Alternate NTGRs for Sensitivity Analysis

Algorithms
NTGR01
X= mean[(max(pd6a pd6c))(pd7a)] **NTGR01=mean(X Time)**
NTGR02
NTGR02=mean(pd6a pd7a Time)
NTGR03
X= mean[(max(pd6a pd6c))(pd7a)] **NTGR03=mean(X Time pd4a)**
NTGR04
E= mean[(max(pd6a pd6c))(pd7aE)] **NTGR04=mean(E Time)** Note: pd7a was transformed into exponential form pd7aE
NTGR05

L= mean[(max(pd6a pd6c))(pd7aL)] **NTGR04=mean(L Time)** Note: pd7a was transformed into log form pd7aL
NTGR06
X= mean[(max(pd6a pd6c))(pd7a)] wtgX=.2 x X wtgtime=.8 x Time **NTGR06=wtgX + wtgtime**
NTGR07
X= mean[(max(pd6a pd6c))(pd7a)] wtgX=.8 x X wtgtime=.2 x Time **NTGR07=wtgX + wtgtime**
NTGR08
X= mean[(max(pd6a pd6c))(pd7a)] **NTGR08=mean(X TimeL)** Note: Time was transformed into log form TimeL to reflect increased value of kWh and kW.
NTGR09
NTGR09 started with the originally filed NTGRs and replaced all NTGRs that were zero with .53.

E

Regression Model Results

Regression Model #1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	10	1.57317	0.15732	2.96	0.0054
Error	49	2.60071	0.05308		
Corrected Total	59	4.17388			

Root MSE	0.23038	**R-Square**	0.3769
Dependent Mean	0.46682	**Adjusted R-Square**	0.2497
Coefficient of Variation	49.35148		

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	0.60795	0.22469	2.71	0.0094
Commercial customer	0.06734	0.0832	0.81	0.4222
Industrial customer	0.05752	0.07595	0.76	0.4525
Number of measures installed	0.1659	0.07076	2.34	0.0231
Square footage	9.35E-08	6.22E-08	1.5	0.1388
Average monthly electric bill	-0.06901	0.0321	-2.15	0.0365
Learned about program before thinki	-0.21251	0.0738	-2.88	0.0059
Intalled equipment to reduce energy	0.18912	0.06607	2.86	0.0062
Developed energy efficiency policy	-0.03961	0.06333	-0.63	0.5346
Multiple locations	-0.02504	0.06506	-0.38	0.702
Learned about program before decid	0.09142	0.08909	1.03	0.3098

Regression Model #2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	0.9492	0.11865	1.66	0.1264
Error	65	4.65681	0.07164		
Corrected Total	73	5.60601			

Root MSE	0.26766	**R-Square**	0.1693
Dependent Mean	0.45726	**Adjusted R-Square**	0.0671
Coefficient of Variation	58.53573		

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	0.29217	0.20738	1.41	0.1636
Commercial Customer	0.14878	0.08215	1.81	0.0747
Industrial Customer	0.04529	0.07739	0.59	0.5604
Number of measures installed	0.04674	0.06973	0.67	0.505
Square footage	2.43E-08	6.22E-08	0.39	0.6972
Average monthly electric bill	-0.03139	0.03203	-0.98	0.3307
Intalled equipment to reduce energy	0.14463	0.06507	2.22	0.0297
Developed energy efficiency policy	0.00612	0.06419	0.1	0.9244
Multiple locations	0.03854	0.06927	0.56	0.5799

Regression Model #3

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	1.53747	0.30749	5.82	0.0002
Error	61	3.22065	0.0528		
Corrected Total	66	4.75812			

Root MSE	0.22978	**R-Square**	0.3231
Dependent Mean	0.48701	**Adjusted R-Square**	0.2676
Coefficient of Variation	47.1814		

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	0.67717	0.16514	4.1	0.0001
EESP versus self-sponsor	0.00356	0.06233	0.06	0.9546
Number of measures installed	0.13287	0.06616	2.01	0.049
Average monthly electric bill	-0.0392	0.02853	-1.37	0.1745
Intalled equipment to reduce energy	0.16777	0.05735	2.93	0.0048
Learned about program before thinki	-0.2096	0.0577	-3.63	0.0006

Regression Model #4

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	1.55239	0.31048	5.91	0.0002
Error	61	3.20573	0.05255		
Corrected Total	66	4.75812			

Root MSE	0.22924	**R-Square**	0.33
Dependent Mean	0.48701	**Adjusted R-Square**	0.27
Coefficient of Variation	47.07197		

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	0.67296	0.13988	4.81	<.0001
Commercial Customer	0.03615	0.06745	0.54	0.5939
Number of measures installed	0.12755	0.06264	2.04	0.0461
Average monthly electric bill	-0.03851	0.02741	-1.41	0.1651
Intalled equipment to reduce energy	0.16116	0.05847	2.76	0.0077
Learned about program before thinki	-0.20445	0.05816	-3.52	0.0008

Logit Model #1

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	12.4674	6	0.0523
Score	11.3622	6	0.0778
Wald	9.7471	6	0.1357

Variable	Estimate	Standard Error	Chi-Square	Pr > ChiSq
Intercept	1.757	1.5372	1.3064	0.253
Commercial Customer	1.3536	0.7388	3.3566	0.0669
Industrial Customer	0.429	0.6131	0.4896	0.4841
Average monthly electric bill	-0.7151	0.2892	6.1141	0.0134
Square footage	-8.24E-08	4.83E-07	0.0291	0.8645
Multiple locations	0.7361	0.5704	1.6653	0.1969
Developed energy efficiency policy	-0.5339	0.5323	1.006	0.3159

Logit Model #2

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	16.9137	7	0.018
Score	14.8888	7	0.0375
Wald	12.2616	7	0.0923

Variable	Estimate	Standard Error	Chi-Square	Pr > ChiSq
Intercept	0.2901	1.6889	0.0295	0.8636
Commercial Customer	1.3802	0.753	3.3597	0.0668
Industrial Customer	0.4979	0.6336	0.6176	0.432
Average monthly electric bill	-0.8037	0.3062	6.8887	0.0087
Square footage	1.44E-07	5.04E-07	0.0813	0.7755
Multiple locations	0.6036	0.5921	1.0393	0.308
Developed energy efficiency policy	-0.4119	0.5499	0.561	0.4539
Number of measures installed	1.2702	0.6304	4.0599	0.0439

Logit Model #3

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	17.3294	5	0.0039
Score	15.3237	5	0.0091
Wald	12.7958	5	0.0254

Variable	Estimate	Standard Error	Chi-Square	Pr > ChiSq
Intercept	-0.7382	1.32	0.3128	0.576
Commercial Customer	1.1757	0.7081	2.7569	0.0968
Industrial Customer	0.1373	0.5963	0.053	0.8179
Average monthly electric bill	-0.6668	0.2832	5.5426	0.0186
Multiple locations	0.6194	0.5518	1.2602	0.2616
Number of measures installed	1.4212	0.604	5.5366	0.0186

F CONSTRUCTION OF WEIGHTS

A variety of weights were constructed: 1) expansion weights based on N, and 2) relative weights. The expansion weight is simply the reciprocal of the selection probability and is calculated as follows:

When examining all strata, the following is used and applied to each stratum:

$$\text{Expansion Weight} = \frac{N_h}{n_h} \qquad \text{(F-1)}$$

where

N_h = Population in stratum h

n_h = Sample in stratum h

While the expansion weight appears reasonable for the estimator of the population total, it may play havoc with the average and other statistical measures. To deal with this, the expansion weight was adjusted to produce a relative weight rw_i, which is defined as the expansion weight divided by the mean of the expansion weights:

$$\text{Relative Weight} = \frac{w_i}{\overline{w}} \qquad \text{(F-2)}$$

where

$$\overline{w} = \frac{\sum w_i}{n} \qquad \text{(F-3)}$$

Another weight, the stratum weight, was also calculated and is presented below:

$$\frac{N_h}{N} \qquad \text{(F-4)}$$

where

N_h = the population within a given stratum

N = the population across all strata

Table F-1 presents the resulting expansion weights as well as the relative weights for each stratum.

Table F-1
Expansion and Relative Weights

Strata	Expansion Weights Based on Incentives	Stratum Weights Based on Incentives	Relative Weights Based on Incentives	Stratum Weights Based on N
1	1.03	0.49	0.53	0.08
2	1.32	0.28	0.68	0.22
3	2.73	0.23	1.41	0.70

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