What a Realization:
An Ex Post Impact Evaluation of a Performance-Based Program

Evaluation of the 2002 California Standard Performance Contract Program

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Abstract

In this paper, we present results from an impact evaluation conducted for California's Nonresidential Standard Performance Contract (SPC) Program for program year 2002 (PY2002). The overall PY2002 evaluation scope included process, market, and impact evaluation components. This paper covers only the gross impact evaluation objective. Independent ex post impact evaluation had never been performed on the California SPC Program prior to this evaluation. In the first years of the Program, measurement of savings was conducted as part of the program participation process and was the basis for incentive payments. Since then the amount of in-program measurement declined dramatically as the program switched to basing savings and incentives on ex ante calculations. The primary goals of the evaluation reported on in this paper are to develop a gross savings realization rate and to provide qualitative feedback on how to improve the SPC Program's resource performance in the future.

Introduction

In this paper, we present results from an impact evaluation conducted for California's Nonresidential Standard Performance Contract (SPC) Program for program year 2002 (PY2002). The overall PY2002 evaluation scope included process, market, and impact evaluation components. This paper covers only the gross impact evaluation objective. Net-to-gross related findings are included in the impact evaluation study and report but are not included in this paper (Quantum 2005). The process and market evaluation results preceded the impact results and were published separately (Quantum 2004).

The California SPC Program

As in previous years, the 2002 SPC Program was administered by Pacific Gas & Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E). The program was open to almost any equipment replacement or retrofit project for which the savings can be verified with a useful life of greater than 3 years. The role of the 2002 SPC Program in the IOU's energy-efficiency portfolio was to encourage custom and comprehensive energy savings projects among primarily large non-residential customers. (Prescriptive measures for smaller customers were captured in the IOU's statewide Express Efficiency Program.)

Under the 2002 SPC Program, the program administrators offered fixed-price incentives to project sponsors for kWh energy savings achieved by the installation of energy-efficiency measures. The per-unit incentive levels for the 2002 SPC program are shown in Table 1. Incentives for gas measures increased from $0.27/therm in 2000 to $1.00/therm in 2001, then dropped to $0.45/therm in

PY2002. Electric incentives have decreased gradually over time since the Program's inception in 1998. The financial incentive could not exceed 50 percent of the project capital cost.

Table 1. 2002 SPC Program Incentive Levels by Measure Type and Year

Measure Type	Incentive per Unit of Savings
Lighting	$0.050/kWh
HVAC&R	$0.14/kWh
Motors/Other	$0.080/kWh
Gas	$0.45/therm

A description of the stages of program documentation is provided to facilitate understanding the references to these stages that follow. There are three primary stages of the project documented in the SPC application. These are:

- **Application Submission**: The customer or project sponsor submits the SPC application and supporting savings calculations and documentation to the SPC Program administrator.
- **Application Review**: The SPC application is reviewed and savings calculations are adjusted, if necessary, and accepted by the SPC program administrator. An incentive offer is formalized at this stage.
- **Installation Report**: Following the installation, the SPC reviewer performs a site inspection to verify the installation and make adjustments, if necessary, to the energy and demand savings claim. The financial incentive is quantified and paid to the customer based on this assessment. In some cases the SPC program administrator required measurement (commonly referred to in the Program as "Measurement and Verification" or "M&V") of the savings for the project. In these cases, the financial incentive was based on the results of the measurement.

Over the five-year history of the California SPC program, whether and to what extent savings are measured versus calculated has been an ongoing issue. In the initial years of the Statewide SPC Program (1998 to 1999), measurement and verification was required for virtually all projects. In 2000 and 2001, the IOUs offered applicants the choice of either a "measured" or "calculated" savings path, offering a higher incentive for the measured path to compensate for the associated measurement costs. In 2002, the "calculated" path became the required default except in cases where the IOU administrators determined that measurement was necessary. Most of the projects in the PY2002 program were done under the calculated path.

The California SPC in Historic Context

Incentive programs for custom and comprehensive non-residential projects in existing facilities have been in existence for over twenty years. Some program features and philosophies have remained relatively stable across this program history, while policymakers and program planners have purposefully changed others to achieve new or expanded program objectives or try to better achieve traditional ones. The convergence and divergence in implementation approaches and strategic objectives among non-residential programs that encourage comprehensive projects is reflected in the specific program types that share this orientation: custom rebate, demand-side bidding, and standard performance contract programs.

Before discussing the ways in which these programs differ, and how they have evolved over time, it is important to understand what they share in common. Some of the common features include the following: Focus on implementation of custom efficiency measures and projects that do not lend themselves to a prescriptive rebate approach; Encouragement of comprehensive projects that go beyond single measures and common efficiency practices; Use of incentive strategies that encourage and allow for custom and comprehensive projects; Inclusion of technical engineering review as part of the incentive approval process; and Requirements for proof of project installation.

The ways in which these program approaches differ is best understood by reviewing the history of their evolution. Custom rebate programs are the oldest of the three program approaches and have been in existence since the earliest days of energy efficiency programs dating back to the 1970s and 1980s. These programs tend to focus primarily on the end user and were historically operated primarily by utilities. Typically, utility account managers and engineering staff played active and important roles in working with customers to identify projects, assess technical feasibility, and move them through the program and implementation process. Incentives were often paid on a cents-per-first-year kilowatt-hour saved basis. These incentives were typically either set at a single level for all types of projects or varied based on end use or load shape impacts. Utility personnel typically performed installation verification. Savings were typically measured for samples of projects to produce estimates of savings at a program level, often by third-party evaluation firms in ex post impact evaluation studies.

DSM bidding programs emerged in the late 1980s and expanded in the early 1990s as demand-side counterparts to supply-side and integrated bidding efforts and represented purposeful attempts to encourage non-utility delivery of DSM program and implementation services (Goldman and Kito, 1994). These programs shifted the focus of DSM resource acquisition from utility-driven efforts to primarily ESCO-driven efforts, particularly with respect to marketing, feasibility studies, and, in some cases, measurement and verification. "Pay for performance" was a core principal underlying DSM bidding programs and significant levels of measurement and verification (M&V) were usually required as the means to determining performance. According to some ESCOs and analysts, the key drawback to DSM bidding was that it required the bidders to commit to achieving a certain level of savings at a given cost prior to identification of the specific customers and projects that would deliver the savings (Goldman, et al., 1998).

Standard Performance Contract (SPC) programs emerged in the wake of DSM bidding programs and were an attempt to address some of the associated challenges of these first generation bidding programs. The principal design modification of SPC programs was that fixed prices were posted for savings and were paid on a first-come, first-served basis. This was intended to make the programmatic process more aligned with the way in which ESCOs normally do business, i.e., on a customer-by-customer, and project-by-project, basis. Another key element that defined the initial SPC programs was a requirement for measurement and verification (M&V). Many considered "pay for performance" and M&V to be central to the SPC program concept, as they were with DSM bidding.[1] The SPC approach was generally viewed positively by the ESCO industry, as represented by the National Association of Energy Service Companies (Gilligan, 2003), although significant numbers of individual ESCOs and energy-efficiency service providers (EESPs) did object to a number of program requirements (Rufo, et al., 2002; Rufo and Landry, 2000).

[1] Public Service Electric & Gas' Standard Offer program, implemented in the mid-1990s, and considered the first SPC-type program, required M&V to be measured for 5 to 15 years depending on the project type. The California SPC program originally required two years of M&V.

Why an Ex Post Impact Evaluation of a "Performance Contracting" Program?

For several reasons, PY2002 is the first year for which an ex post impact evaluation was conducted for the California SPC Program. First, the original program design required measurement of savings for all projects. As noted above, the pay-for-performance element of the program was central to the program and the basis for its name. With all projects subject to measurement requirements, there was little justification for an ex post impact evaluation. Second, the energy-efficiency policy environment in California from 1998 to 2000 had moved strongly toward a market transformation orientation that did not allocate resources or a high priority to the types of ex post impact evaluation conducted by the IOUs earlier in the 1990s. With the shift in the policy environment strongly back toward resource acquisition in 2001, the SPC program's move toward calculated instead of measured savings, and the California Public Utilities Commission's priority on energy efficiency as the first resource in the IOU's resource procurement load orders (CPUC 2004), the importance of conducting an ex post impact evaluation increased significantly for the 2002 program year.

The 2002 SPC gross impact evaluation provides results on verification, ex post energy savings estimates, and gross savings realization rates. Although the objectives of the impact evaluation were fairly comprehensive, the resources available to conduct it were relatively limited. The level of ex post site analysis and measurement conducted for this evaluation was significantly less than what was typical during the 1990s for IOU's custom incentive programs when the California DSM Measurement Advisory Committee (CADMAC) impact evaluation protocols were required.

As a result, it is important for readers to understand the scope and limitations of the 2002 SPC impact evaluation within the following context. First, the types of projects that were evaluated were the most complex energy savings projects in the energy efficiency program portfolio, as well as the largest contributors to total savings and overall cost-effectiveness. By definition, most of these projects were unique as carried out at each site, which limits the power and accuracy of statistical extrapolation from the samples. Second, the total budget available for the impact evaluation was about an order of magnitude smaller than the level of effort expended on the IOU's on ex post impact evaluations for similar programs (i.e., custom type projects for large nonresidential customers) in much of the 1990s under the evaluation protocols in place during that period.[2] Consequently, the person-hour budgets per site were much less than those typical for these types of projects under the previous evaluation protocols, which constrained measurement and monitoring activities. Similarly, the sample sizes used in the current study are also smaller than what would have been required under the previous CADMAC protocols. Third, we note that an ex post impact evaluation was not required for the PY2002 SPC program by the CPUC.[3] The evaluation team voluntarily put forth the plan to conduct this study for reasons further discussed below.

Readers may ask why the evaluation team pursued this effort given the limitations and caveats above. The answer is that the evaluation team believed that it was important to begin the process of ex post impact evaluation for the SPC program for PY2002 for the following reasons: 1) The resource value of all programs was of greatly increasing importance to the CPUC and IOUs when the evaluation plan was developed in 2002. 2) The evaluation team believed that the California IOUs and CPUC would want to adopt a more rigorous ex post impact evaluation process for PY2006 and beyond (when the CPUC's new aggressive energy-efficiency goals go into effect). 3) The evaluation team believed that

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[2] The protocols can be found at http://www.calmac.org/cadmac-protocols.asp.

[3] Note that only a very small number of PY2002-PY2003 utility or non-utility programs included ex post impact evaluation, as this was not a CPUC requirement for those program years.

even a constrained effort would generate important lessons learned for program managers, planners, evaluators, and policy makers for future program years, when even more resources, and perhaps program administrators' performance incentives, would be at stake. 4) Because SPC projects typically take 6 to 24 months to be installed after acceptance of program applications, the evaluation team believed that waiting until later program years to begin the ex post impact evaluation process would delay the associated learning by far too long.

Approach

The primary objective of the 2002 SPC impact evaluation is to generate findings and recommendations that will improve program and evaluation planning. Specific aspects of this objective include the following: 1) Establish a process for conducting ex post evaluation for this program type; 2) Conduct site-specific ex post savings analyses; 3) Implement the process for a small but representative sample of sites; 4) Estimate program savings for the sampled sites; 5) Extrapolate savings from the sample to the program population; and 6) Develop recommendations for how program savings and evaluation efforts can be improved.

Sample Design

A sample of participating 2002 SPC customers was selected for primary data collection and downstream verification and engineering analysis. We drew a sample that was proportionally distributed with respect to size of savings, end use, type of sponsorship, and utility. The sample was drawn from customers with active applications as of March 2003. Electricity makes up roughly 90 percent of the savings and incentives for the PY2002 SPC program. Consequently, given budget constraints, it was agreed that the impact evaluation would focus on measuring electricity savings. Thus, the primary sampling variable is electricity savings at the customer level. We determined that three proportional savings strata would be optimal. The strata each represent approximately one-third of program electricity savings. We refer to these as tiers, with Tier 1 being the tier with the largest projects and Tier 3 the smallest.

A second stratification variable used was end use, as defined by the program. The program pays incentives based on whether projects are classified as Lighting, HVAC/R, or Other.[4] Many projects contain measures from more than one end use. The end use with the largest energy (kWh) savings in an application was assigned as the "primary end use" for the sample design. Stratifying on program end use ensures that the sampled mix of projects is representative of the population mix and allows us to calculate realization rates by end use.

The program population data for the sampling strata are shown in Table 2. These figures were based on data received from the utilities in March 2003. The final sample completed was for 40 customers, as shown in Table 3. We originally selected all 11 customers from the first strata, which represent those customers with the largest savings, but were able to evaluate only 6 of those customers since 4 customers had not completed their projects and one customer did not cooperate with the evaluation. We randomly sampled from the remaining strata and allocated sample points to maximize confidence and precision on program savings. The energy savings associated with the actual sample completed is shown in Table 4. With these 40 points, we were able cover approximately 40 percent of the population savings.

[4] Note that, for payment purposes, "Other" includes industrial process and many controls measures, even controls that apply only to lighting or HVAC/R.

Table 2. Electric PY2002 SPC Population Data by Stratum and End Use

		GWh Savings			
kWh Strata	No. of Customers	Lighting	HVAC/R	Other	Total
Tier 1	11	17.5	14.0	46.2	77.7
Tier 2	35	17.9	18.4	44.3	80.5
Tier 3	215	14.3	19.6	46.4	80.3
Total	**261**	49.6	52.1	136.8	238.5

Table 3. Actual Electric Impact Evaluation Sample Completed – Number of Customers

	End Use			
kWh Strata	Lighting	HVAC/R	Other	Total
Tier 1	2	2	2	6
Tier 2	7	6	7	20
Tier 3	4	6	4	14
Total	**13**	**14**	**13**	**40**

Note: 43 Evaluations were performed representing 40 customers.

Table 4. Actual Electric Impact Evaluation Sample Completed – Sampled kWh Savings

	Sample Points	GWh Savings			
kWh Strata	Total (Ltg,HVACR,Other)	Lighting	HVAC/R	Other	Total
Tier 1	6 (2,2,2)	8.3	12.5	31.9	52.7
Tier 2	20 (6,5,9)	13.6	8.9	15.0	37.5
Tier 3	14 (4,6,4)	1.6	1.3	1.6	4.5
Total	40	23.5	22.7	48.5	94.7

Note kWh based on March 2003 Tracking data.

Estimating Ex Post Energy Savings

The key steps involved in developing the overall savings estimate for the program were to: 1) develop site-specific ex post analysis plans for each site in the sample; 2) conduct on-site visits to independently verify reported measure installation records; 3) use data collected from the on-site visits and limited monitoring to develop ex post estimates of the energy savings for each project in the sample; and 4) apply those findings to the full participant population to obtain a complete estimate of program impacts.

Ex post impact experience with custom nonresidential projects shows that program effects cannot be reliably measured through a multi-customer regression analysis of billing data (an approach typically employed in ex post residential analysis and prescriptive commercial programs). In the past, evaluators have found that this is true due to the fact that custom sites are often also large customers (typically using in excess of millions of kWh per year) for whom it is difficult to isolate program effects in the billing regression model because of the many site-specific changes that affect consumption (in addition to program changes). For this reason, we adopted the approach used in the previous evaluation protocols and primarily relied on application review, on-site data collection, engineering analyses, and limited (mostly spot) measurements to produce ex post gross impact estimates. However, for some projects that had been completed several months before our evaluation, we also used individual customer pre- and post-retrofit billing records to verify calculated impacts.

Review Applications and Prepare Analysis Plans. For each selected application, we performed an in-depth application review to assess the engineering methods, parameters and assumptions used to generate all adjusted ex-ante impact estimates. Application review served to familiarize the assigned evaluation engineer with the gross impact approach applied in the ex ante calculations. This also allowed an assessment of the additional data needs that were required to complete each analysis and the likely sources for obtaining those analytic inputs.

The ex post methods applied varied in complexity from applications that required an entirely new approach, to those that required an independent calculation using the application-based approach, and finally to those that simply required a careful review and verification of the methods and inputs in the ex-ante calculations.

Conduct On-Site Data Collection. On-site audits were completed for 40 of the customers sampled. During the on-site audit, data identified in the analysis plan was collected, including monitoring records (such as instantaneous spot watt measurements for chillers or other installed equipment, measured condensate temperatures, data from chiller logs, and energy management system (EMS) downloads), equipment nameplate data, system operation sequences and operating schedules, and, of course, a careful description of the baseline condition being modeled.

The on-site audit consisted of a combination of interviewing and taking measurements when appropriate and possible. During the interview, the evaluation team engineer met with a building representative who was knowledgeable about the site's equipment and operation, and asked a series of questions regarding such matters as operating schedules, location of equipment, and equipment operating practices. Following this interview, the engineer made a series of detailed observations and measurements of the building and equipment.

Conduct Site-Specific Verification and Develop the Ex Post Impact Calculations. The application-based estimates of demand and energy impacts were examined and revised as necessary, based on the ex post on-site data (which included observations, interviews, collection of customer data logs, and, in some cases, spot or short-term monitoring). In some cases, pre- and post-billing data was used when a billing analysis was conducted. Calculations were performed at a variety of levels of complexity using methods that included bin models, application of ASHRAE methods and algorithms, and other specialized algorithms and models. In many instances ex post impact estimates were derived by utilizing a different approach from that used in the ex ante calculations. This was especially true for the Process and HVAC end uses. In other cases, the same methodology was employed but with data inputs that were based on findings from our site visits. During the site visit, the evaluation engineer also verified that the proposed measures had been installed as detailed in the SPC application.

Estimate Impacts for Participant Population. Based on these 40 customers, engineering-based realization rates were derived at the strata and program end use levels (i.e., for the cells in the sampling matrix). The realization rate is defined as the ratio of ex post-to-ex ante energy savings impact. These realization rates are applied back to the remaining participant population by applying the realization rates from the sample to the population within each cell of the sampling matrix. The realization rates within a sampling cell are weighted by the size of the savings for each customer in the sampled cell. The realization rates are also weighted across the sampling cells based on the ratio of the total savings for the population of participants in the cell to the entire program savings.[5]

[5] The overall program realization rate and confidence interval utilize the ratio-estimation methods documented in TecMKT Works 2004 .

Results

In this section we present and discuss the overall realization rate[6] results of the gross impact analysis. The results are first discussed on an *unweighted* basis by program end use (process/other, lighting, and HVAC). We then present weighted results for the entire program. Detailed site-specific project descriptions, ex ante methods, ex post methods, ex post results, and a qualitative assessment of the level of documentation supporting the SPC ex ante calculations are provided in the full evaluation report (Quantum 2005).

End Use Results

Process. Sixteen projects classified under the process end use were evaluated in the sample. The energy savings approved by the program administrators for the process end use were 47.4 GWh. A single site (Site 2), dominated the process end use group. This site accounted for 27 GWh of the ex ante savings for the Process end use. Based on savings data in the sampled SPC applications, this equated to 81 percent of savings for the Tier 1 Process cell in the sample, 61 percent of the Process savings across all three tiers of the sample, 20 percent of all Process savings for the program population, and 11 percent of the entire program savings. The realization rates for the process-related energy savings ranged widely from 0.38 to 1.56 across the 16 sampled sites. The *unweighted* average realization rate for the process energy savings was 0.92. The kWh realization rate for the largest site (Site 2) in the program was 0.38.[7] As discussed further below, the effect of this site on the *weighted* average realization rate was significant.

Lighting. Thirteen projects classified under the lighting end use were evaluated in the sample. The energy savings approved by the program administrators for the lighting end use were 19.1 GWh. The realization rates for the lighting energy savings ranged from 0.70 to 1.25. The unweighted average realization rate for the lighting energy savings was 0.94.

HVAC. Fourteen projects classified under the HVAC end use were evaluated in the sample. The energy savings approved by the program administrators for the HVAC were 17.2 GWh. The realization rates for the HVAC energy use range from 0.05 to 1.36. The unweighted average realization rate for the HVAC energy savings was 0.89.

Overall Program Realization Rates

The unweighted average kWh realization rates are very consistent across end uses, ranging from 0.89 to 0.94, with an unweighted average value of 0.92 for all end uses. This indicates that the ex ante savings estimates were reasonably conservative on average across projects. However, there was a wide range of realization rates and because of low realization rate for Site 2 and a few other large sites, the overall weighted realization rate for the program is lower than the unweighted average, as discussed below.

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6 Realization rates were developed for each site and the program as a whole and are defined as the ratio of program ex ante savings divided by the ex post savings estimated by the evaluation team.

7 Site 2 involved an industrial process modification that includes the installation of natural gas fired equipment, which contributed strongly to the reduction in electric energy. The program also did not properly account for the increase in natural gas usage at the site, which the evaluation team estimates was in excess of 800,000 therms annually.

To produce the overall program realization rate, the individual realization rates for each of the sample points were weighted by the size of the savings associated with the project and the proportion of the total program savings represented by each sampling cell. The population weights were based on the tracking data obtained in March 2003. The weighting for the overall realization rate was adjusted for two factors. First, because Tier 1 had so few sample points in each end use, Tier 1 and Tier 2 were collapsed by end use for the final weighting. Second, because Site 02 is so large compared to the rest of the sites, representing 10 percent of the population tracking savings, and is a unique process system it is treated as its own tier. Site 02 clearly stands out as an extreme outlier in the analysis as shown in Figures 1 and 2, which present the ex ante and ex post savings for the sample with and without Site 02 included. As shown in the figures, the correlation between the ex ante and ex post estimates is high without Site 02 included, but quite low when it is included.

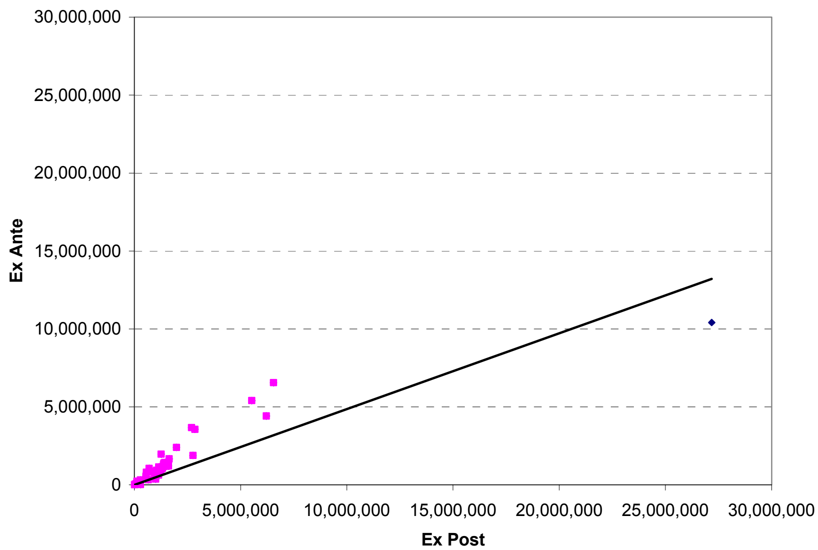

Figure 1. Correlation of Ex Ante and Ex Post Savings (kWh) with Site 02

The realization rates in the final cells used for the weighting and extrapolation to the program population, as well as the overall weighted program realization rate and the associated confidence interval are show in Table 5. The overall weighted realization rate is 0.79 with a 90 percent confidence interval of 0.73 to 0.85. As noted above, the unweighted realization rate for the sample is 0.92. The weighted realization rate is lower because of low realization rates for Site 02 and the Tier 3 process end use. The weighted average realization rate is the primary result of interest since it captures the relative contribution of different sized projects and end use to overall program savings. As discussed in the Conclusions, this underscores the importance of focusing extra analytical resources and attention on the very largest projects in the program.

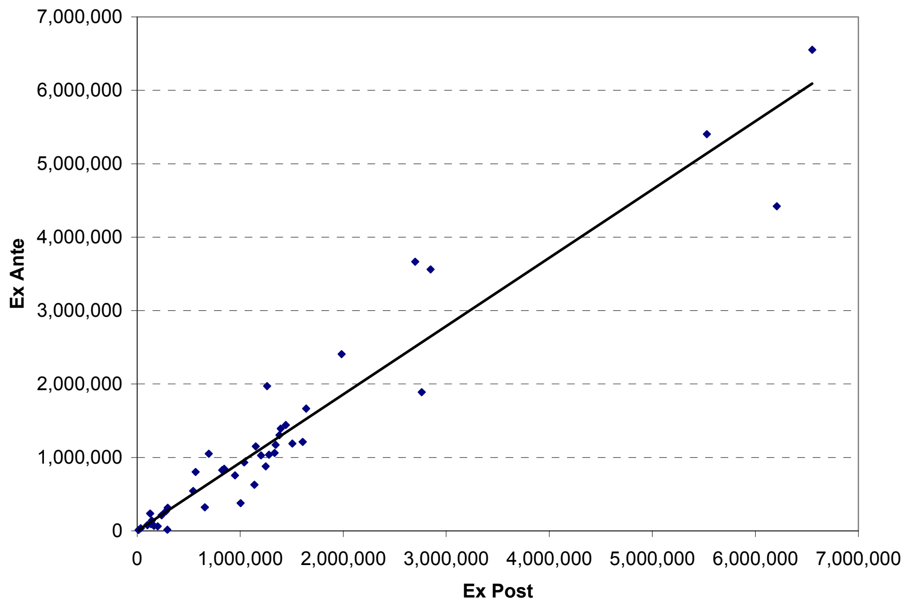

Figure 2. Correlation of Ex Ante and Ex Post Savings (kWh) without Site 02

Table 5. Overall Program Realization Rate and by Sampling Tier

Sampling Strata	Lighting	HVAC/R	Process/Other
Tier 0 (Site 02)	--	--	0.38
Tier 1 & 2 Combined	0.89	0.93	1.02
Tier 3	0.99	0.73	0.48

Total Weighted Program Realization Rate	0.79
90 Percent Confidence Interval	0.73 to 0.85

Note that the confidence interval does not capture any of the uncertainty in the ex post savings estimate. The confidence interval only captures the effect of the variation in the ex post to ex ante ratio of the sample with a finite population factor correction that reflects the population of program participants. That is, it is as if the ex post values were known precisely without measurement error. This approach used to develop the confidence interval is consistent with the requirements of the CADMAC evaluation protocols and is constrained by the practical limitations associated with aggregating results from complex projects that use a variety of estimation approaches. It is likely that the confidence interval would be considerably wider if the uncertainty in the ex post estimates could be statistically quantified.

Conclusions

The results of the impact portion of the 2002 SPC evaluation reinforce the need for ex post evaluation of the formerly performance-based California SPC program. Because the savings for most of the projects in the 2002 SPC were calculated not measured, the program has, for evaluation purposes, become more like a custom rebate program than a performance-based one. The program administrators' expressed philosophy is to be conservative when approving applicant's calculation-based savings estimates. In theory, such conservatism should lead to an ex post realization rate above 1.0. The evaluation-based realization rate of 0.79 indicates that the ex ante savings estimates may not be as conservative as the program administrators' intended. This is particularly true for the process end use overall and one particularly large individual process site that represented 11 percent of the entire program savings. These process-related realization rates were lower than those for lighting and HVAC.

At the same time, it is important to acknowledge that there is significant uncertainty in the ex post results. There are two primary reasons for this. First, the evaluation budget was small as compared to the size of the statewide SPC program[8] and complexity of projects. As a result, although the scope of the ex post evaluation did include detailed review of project files, on-site verification of measure installation, re-analysis of available customer data, on-site interviews, and limited spot and short-term monitoring to ascertain key energy savings analysis assumptions, it did not include significant and longer term ex post monitoring. This limitation was well known and expected by the evaluation research team at the outset of the study and reinforced the team's recommendation to increase available evaluation resources for future ex post evaluations of this program.[9] The second major contributor to uncertainty in the overall realization rate is related to the sampling. There is a great deal in variation in the types of projects in each of the sampling cells used to extrapolate the individual site realization rates to the program as a whole. Each of the major end uses is comprised of many different site-specific projects. In particular, the process/other end use is comprised almost entirely of unique site-specific measures.

In developing the ex post savings estimates, a significant effort was put into reviewing the SPC application files with respect to project documentation and the technical review conducted by the program administrators and their support contractors. As a result of this review and the realization rate analyses, we developed a set of recommendations aimed at helping to improve the resource reliability of the program, while trying to remain sensitive to the need to keep the program implementation process from becoming overly complex or difficult (which was the concern in the early years of the program. The recommendations developed included: 1) Increasing the level of technical documentation required by applicants; 2) Further standardizing the review approach and documentation requirements for recurring complex projects; 3) Improving documentation of each project's final ex ante savings; 4) Including professional engineer sign off for very complex projects; 5) Increasing the conservativeness of the ex ante savings estimates; 6) Increasing pre- and post measurement for very large projects and those with highly uncertain baseline conditions; and 7) Moving the ex post evaluation and reporting of savings onto a paid-year rather than program year basis.[10]

The SPC Program has gone through several changes since its inception in 1998, particularly as related to the amount of in-program measurement of energy savings and application documentation that program administrators require. Significant strides have been made to streamline the application process, standardize the calculation methodology, and simplify the review process while striving to maintain confidence in the savings estimates associated with each application. In this evaluation, we

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[8] The 2002 Statewide SPC budget was approximately $23 million and the impact evaluation was less than one percent of the program budget.

[9] A larger portion of the evaluation budget will be allocated to impact evaluation for the PY2004-2005 SPC Program. In addition, the CPUC is currently planning to increase the amount of impact evaluation conducted for the PY2006-2008 period for the entire portfolio of California IOU efficiency programs (CPUC, 2005).

[10] Although this is important for all programs, it is particularly an issue for the SPC program because many of the projects take up to two or more years to install after program year funds have been committed. This caused long delays in conducting the 2002 SPC impact evaluation. In addition, a number of projects also end up canceling after the program year.

identified several important ways that energy savings estimates could be further improved. Most of these changes should be relatively easy to address and result in an increase in the certainty of the SPC Program's resource value. This is especially important given the Program's large contribution to the California IOU's energy-efficiency portfolio and its unique role in supporting complex and comprehensive energy-efficiency projects that would otherwise not be captured through prescriptive approaches.

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