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2010-12 WO033
Custom Impact Evaluation
Interim Report

Final Draft

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Executive Summary

This report for CPUC ED Work Order 33 (WO033) presents interim findings from the impact evaluation of the 2010-2012 California investor-owned utilities' (IOU) energy efficiency programs, focusing on custom measures. More than 100 utility programs include custom, non-deemed projects. This evaluation effort investigates those custom measures and offerings across all IOU programs, addressing savings claims for the period 2010 through the second quarter of 2011. It should be noted that gross impact results are available at this time for roughly one-half of the measurement and verification (M&V) sample covering this period.[1] Evaluation activities are underway for the remainder of the program cycle (Q3 2011 through 2012).

The scope of work for the evaluation of custom measures includes an independent estimation of gross and net savings along with findings and recommendations that can be used to improve program and project application effectiveness.

Three main evaluation activities support the majority of this report: (1) M&V activities for estimating gross impacts, (2) telephone survey data collection for determining NTGR estimates, and (3) engineering desk review activities supporting the lower rigor assessment. The lower rigor assessment is an evaluation approach used in this report to enable the assessment of a larger proportion of the IOUs' portfolio of programs than would otherwise be possible through a relatively expensive stratified random sample of M&V points.[2]

1.1 Gross Impact Results

Evaluation gross impact results are preliminary at this time, as results are based on relatively small sample sizes and are not weighted. For this reason the results presented here focus on qualitative findings. This subsection begins with preliminary realization rate results based on completed M&V projects to date.

[1] The remainder of the first period M&V sample is expected to be evaluated by March 2013. All M&V sample points in this program cycle are expected to be completed by December 2013.

[2] See Chapter 5 of this report for a description of the lower rigor assessment activities.

1.1.1 Preliminary Realization Rates by Sampling Domain

Table 1-1 below presents un-weighted realization rates for each of the five sample domains for the evaluation 'before decision' (BD) period.[3] The unweighted mean realization rate is shown for kW, kWh and therms, along with the instances where the realization rate is higher than 125%, lower than 0% (signifying an energy penalty) and equal to 0% (signifying no energy savings). The total number of sample points by domain and the total number of completed M&V points are also shown.

Table 1-1: Realization Rates by Sample Domain and Energy Metric (kWh, kW, and therms) – Completed Sample Points – BD Period, Excluding Most Extreme Points (Outliers)

Sample Domain	Sample Count	Complete Count	Percent Complete	Without Extremes (RR>3 or RR<-3)			
				RR Mean	RR > 125%	RR = 0%	RR < 0%
PGE Electric							
kWh*	50	30	60%	0.744	6	3	1
kW	-	24		0.670	2	1	1
PGE Gas							
Therms*	40	26	65%	0.766	4	0	1
SCE Electric							
kWh*	50	21	42%	0.609	1	2	0
kW	-	19		0.613	2	3	0
SDGE Electric							
kWh*	30	6	20%	0.604	0	1	0
kW	-	4		0.720	1	1	0
SDGE and SCG Gas							
Therms*	30	12	40%	0.588	1	1	0

Note: Results are preliminary and un-weighted.

* Primary sample was designed and selected at this level.

This table illustrates evaluation progress on the BD period sample (roughly half of the sample - 99 points - is complete). While results for some domains are based on a relatively high

[3] The before-decision (BD) period includes the program cycle period prior to dates stipulated in Decision D. 11-07-030 and entails completed projects from 2010 through the second quarter of 2011; the after-decision (AD) period refers to the remainder of the program cycle. The decision is located at: http://docs.cpuc.ca.gov/published/FINAL_DECISION/139858.htm. Decision 11-07-030 allows for the 'ex ante review' of selected projects, allowing additional oversight for selected projects. The two periods can differ in ex ante approach, with implications for evaluation planning and sample design. The evaluation plan supports separate reporting of BD and AD results if warranted, including separate reporting for all points selected for ex ante review.

proportion of targeted completes, such as PG&E-gas, others are too incomplete at this time to place much confidence in the results, even directionally, such as SDG&E-electric. Furthermore, results are not yet weighted, pending a more complete sample at a future reporting date.

1.1.2 Reasons for Differences Between Ex-Ante and Ex-Post Gross Impact Results

The two principal reasons that ex-ante gross impacts differ from ex-post results are: (1) observed operating conditions, and (2) baseline specification. To bring ex-ante estimates and ex-post results into closer alignment, the IOUs must make improvements to ex-ante impact estimates in these two areas.

Enhanced M&V by the IOUs, including increasing pre- and post-installation measurement and verification,[4] is one potential activity that would likely reduce discrepancies involving operating conditions. Given the continued pattern of gross realization rate results falling below unity, the IOUs are also encouraged to use a more conservative set of assumptions for pre-retrofit and post-retrofit operating conditions, where full M&V is not warranted, in order to bring ex-ante claims into better alignment with evaluation-based results.

A more concerted IOU effort is needed to conform to baseline specification practices outlined in Decision 11-07-030, and to provide related documentation of project cost parameters that mirror the baseline condition.[5] Recommendations to improve these baseline specification practices were extensive in previous program evaluations, including the 2006-2008 CPUC EM&V evaluations for custom programs. Calculation methods applied by the IOUs were also found to be an area in need of improvement in 18 percent of the cases examined in the lower rigor assessments.

Other reasons for differences were observed infrequently, but include the following: incorrect equipment specifications, ineligible equipment, and incorrect measure counts.

1.1.3 Effect of Individual Project Results

It is important to note that a small number of projects can have a big influence on the resulting gross impact realization rate result. Even on this preliminary basis, the large influence of a small number of projects is evident. This can be due either to the size of a particular sample point[6] or

[4] While balancing the total expenditures on in-program M&V within the overall program cost effectiveness goals and constraints.

[5] It is acknowledged that at the time the projects being evaluated were moving through the programs, the IOUs had not yet embraced the coming baseline policy change in Decision D. 11-07-030 that occurred in summer 2011.

[6] This is a possible concern once impact results have been properly weighted. However, since this was not an objective of this interim report, it is not a factor at this time.

due to relatively high, low, or even negative realization rates. We have seen this influence already in the PG&E-gas domain, where the resulting realization rate is highly dependent upon the contribution from a relatively small number of points with realization rates falling far from the mean.

This finding suggests that the IOUs should fully investigate high/low/negative realization rates to gain a clear understanding of the drivers of such points, and to incorporate corrective program verification procedures based on likelihood of being sampled due to size and the risk of attaining low realization rates (and the accompanying risk to the program / portfolio results). Examples of corrective verification procedures include possible program requirements for additional high level internal review, for clearly listing / reviewing baseline specifications in application documentation and for requiring additional targeted measurement. The evaluation has already identified some of the types of projects and factors that can drive high/low/negative realization rates. This includes self-sponsored projects where non-IOU fuels, cogeneration, and/or energy transportation are involved. Large and complex projects, such as these, should require significant pre-installation and post-installation M&V including on-site verification and, where necessary and appropriate, monitoring activities.

1.1.4 Gas Project Realization Rates

Preliminary gross impact realization rates for gas projects are higher for PG&E when compared with past evaluation results. This suggests improved project execution and implementation in an area of notable poor performance in the 2006-08 program cycle.[7] Given that roughly three-fourths of the sample for the PG&E BD period is complete, there is room for cautious optimism that this finding will hold; however, we remind the reader that realization rates can be quite sensitive to the effects of a small number of large projects, or a small sample of projects within a large stratum, with very high or low (including negative) realization rates.

1.2 Net-to-Gross Results

Evaluation net-to-gross ratio (NTGR) results are supported by a substantial number of telephone survey completes as shown in Table 1-2. While NTG survey data collection is not yet complete, a large enough number of surveys have been completed to calculate a weighted NTG ratio for nearly every major sampling domain and for numerous programs of interest.

1.2.1 Depth and Reach of NTG Ratio Results

Summary NTGR results are presented in Table 1-2 for Core programs for all IOUs except SCG. Results for programs and program groups are presented in Chapter 4, in accordance with the sample design.

[7] http://www.calmac.org/publications/PG&E_Fab_06-08_Eval_Final_Report.pdf

Table 1-2: Weighted Net-to-Gross Ratios by IOU for Utility Core Programs

	PG&E - Electric	PG&E - Gas	SCE - Electric	SDGE - Electric
	All PGE Core	All PGE Core	All SCE Core	SDGE Core[1]
Program Sampling Strata	NTGR			
1	0.44	-	0.56	-
2	0.45	0.65		0.52
3	0.59		0.47	
4	0.42	0.67	0.42	0.56
5	0.38	0.44	0.47	0.30
Weighted NTGR	**0.46**	**0.62**	**0.50**	**0.49**
90 Percent CI	0.408 to 0.512	0.578 to 0.653	0.456 to 0.535	0.44 to 0.533
Relative Precision	0.11	0.06	0.08	0.10
n NTGR Completes	101	59	61	20
N Sampling Units	1045	236	852	98
ER	0.72	0.33	0.39	0.29

From this table, we offer the following observations for utility Core programs:

- PG&E Core programs achieved weighted NTGRs of 0.46 for electric projects and 0.62 for gas projects.
  - The results for the electric fuel domain have not improved as compared to PY2006-2008 evaluation results for industrial programs for PG&E.[8] NTGRs by size stratum are clustered in the 0.38 to 0.45 range, with the exception of Stratum 3, which had a value much higher than those for the other strata, and for the Core program as a whole.
  - However, there has been a significant increase in the weighted NTGR for PG&E Core gas programs as compared with the PY2006-2008 evaluation referenced above. The weighted NTGR of 0.62 is twice as high as the PY2006-2008 NTGR for gas projects of 0.31. NTGRs by size stratum are similar, with the exception of Stratum 5, which again achieved a much lower value.
- SCE's Core programs' weighted NTGR is 0.50, about 20 percent lower than that for its Industrial Programs in PY2006 – 2008, which had a weighted NTGR of 0.63. There is some variation across size strata. The largest Stratum 1 and 2 projects achieved the highest weighted NTGR (0.56), while those for Strata 3, 4 and 5 were significantly lower (0.42 to 0.47).
- SDG&E's weighted NTGR for its electric projects averaged 0.49, although the results by stratum varied considerably. Stratum 5 projects, in particular, had a very low weighted NTGR (0.30).
- For the Sempra-gas domain there are not enough telephone survey completes at this time to adequately support weighted results.

1.3 Lower Rigor Assessment Results

The lower rigor assessment (LRA) effort provides cost-effective, program-specific, impact-oriented findings and feedback. The 200 sites selected for the M&V gross impact study were supplemented with 100 sites that received a less rigorous review – a lower rigor assessment. The lower rigor assessment entailed the following items: a review of project application paperwork received from the IOU and an assessment of the documentation provided; assessment of the adherence of projects to rules and guidelines; and an assessment of savings estimation techniques. Refer to Chapter 5 and Appendix C for more information on the details of the lower rigor assessment process, an LRA form, and an explanation of issues assessed. Chapter 5 includes a complete description of the process and detailed reporting of results and program specific findings. Appendix D also contains descriptions of LRA findings for several sample

[8] http://www.calmac.org/publications/PG&E_Fab_06-08_Eval_Final_Report.pdf

points and Appendix E describes in detail the lower rigor assessment process for the sample points.

Aggregate results across all completed lower rigor assessments are presented in Table 1-3. For each issue area the number of contributing assessments and the percent scoring "Good," "Neutral" and "Poor" are shown. Program-level results are presented in the main body of the report. Programs are examined in each of these issue areas relative to average performance across programs. This section closes with a presentation of key program-level findings.

Table 1-3: Lower Rigor Results, All Assessments

Key Issue Assessed	Assessment Results (n)	Assessment Results (%)[9]		
		Good	Neutral	Poor
Project Documentation and Specification				
IOU Application Documentation Complete and Accurate	298	44%	32%	24%
IOU Tracking Data Complete and Accurate	296	37%	41%	22%
Project utilized pre-installation M&V	235	40%	24%	37%
Appropriate Baseline	273	81%[10]	0%	19%
Early Replacement Claim: Valid RUL / EUL Approach Used	156	65%	0%	35%
Appropriate Calculation Method				
Appropriate Impact Calculation Method	277	49%	33%	18%
All Relevant Inputs Considered	270	82%	0%	18%
Adequate Values for All Inputs	265	36%	45%	19%
Appropriate HVAC Interactive Effects Calculation Method	12	25%	0%	75%
Appropriate non-HVAC Interactive Effects Calculation Method	53	75%	15%	9%
Project utilized post-installation M&V	296	29%	33%	38%
Compliance with Program Rules				
Measures are IOU Program Eligible	286	99%	0%	1%
Measures Exceed Code or Industry Standard Practice	251	91%	0%	9%
Multiple IOU Fuel Impacts Properly Accounted for (includes Fuel Switching and Cogeneration)	17	47%	0%	53%
If Applicable, Fuel Switching Supported with Three Prong Test	8	38%	0%	63%
Non-IOU Fuel and Ancillary Impacts of Project Properly Accounted for (Cogen/Waste Heat Recovery/ Refinery Gas, etc.)	79	24%	0%	76%
Customer Installation Meets All Program Rules	281	90%	0%	10%

These results demonstrate that the IOUs are in most cases ensuring measures are program eligible, exceed code or standard practice and that customer installations are in conformance with program rules. Over 90% of observations meet these criteria/requirements.

[9] See Chapter 5 for an explanation of the quality of results.

[10] Baseline was not an issue of great concern in the LRAs; of the 273 sites able to be assessed, 81% or 221 sites seemed to possess a good baseline determination from the IOU application desk review process. About 81% of the M&V projects did not identify the baseline as the primary factor for the discrepancy between ex-ante claims and ex-post impacts. However, baseline remains a significant area for improvement with respect to the gross impact M&V results due to the extent of the effects on ex-ante claims.

An area that did not appear to be a widespread cause for concern, based on results from the LRA process, is IOU baseline selection, which was found to be appropriate 81% of the time across all projects evaluated. Still, there is room for improvement, given that the other 19% receive a below average rating and given that fact that small numbers of projects can have significant effects on overall savings claims and evaluation-based realization rates. The M&V gross impact analysis for specific sites clearly highlights that baseline determination is still a significant issue.

From the lower rigor assessment, the use of pre- and post- installation M&V is commonly a cause for concern across the portfolio of custom projects. It is an area that appears to have opportunity for improvement, if it can be expanded and enhanced strategically to ensure the benefits of additional in-program M&V are not outweighed by the costs.

There were several areas which showed a significant percentage of projects with poor scores. An area in which many projects were found to receive a poor ranking was in the proper accounting of non-IOU fuel / ancillary impacts; 60 projects (76% of 79 projects for which this was applicable and able to be evaluated) have a poor rating, highlighting this as an area for improvement. Ancillary impacts included maintenance and costs savings, along with non-IOU fuels, and can be important project drivers. Evaluations should have access to accurate data surrounding all relevant project impacts and considerations.

Other results of mention may not be representative due to small sample size but are important issue areas for closer examination by the IOUs. One issue area evaluated for 12 projects was the 'Appropriate HVAC interactive effects calculation method' which received a poor score for 75% of the projects. Particularly for non-lighting projects, HVAC interactive effects are often overlooked and are an area for improvement. The proper accounting of multiple IOU fuel impacts is a factor in 53% of the 17 projects where this was applicable and able to be evaluated. Fuel switching was only applicable in 8 cases examined, but for 63% of those cases, the three prong test was not provided.

The reader should note that 'lower rigor' results are *qualitative* and not definitive. They do not necessarily correlate with or predict the outcome of rigorous M&V.

1.4 Recommendations

A list of recommendations that appear in the main body of this report are included below. Recommendations mentioned earlier in this chapter are sometimes repeated here. Findings supporting the recommendations below are included in Chapter 6 of this report.

1.4.1 IOU Project Documentation

- As part of project closeout, the IOU, or third party implementer, or both, should make certain the sources of final measure savings are clearly identified, stored and available in the project archive, using a final closeout report. The IOUs should make certain the pre-installation report is complete and accurate. The post-installation reports should also be complete and include operating data where feasible.
- Project documentation should be thoroughly checked and should be cross verified with the reported tracking data before sending the files to evaluators.
- Data responses from the IOUs should indicate clearly when the data being requested is not available.
- The IOUs should provide all project supporting documents including as-built mechanical drawings, equipment specifications, cut sheets, and light plans when responding to data requests from ED.
- Quality control checks should be performed on all accepted applications tracking data entries.
- As a general guideline, all project documentation should be compiled in one electronic location.
- All tracking and related documentation systems should be fully transparent with respect to the retrofit activity completed.

1.4.2 IOU Project Tracking

- As part of post inspection closeout, the IOU should make certain that all measures are clearly identified in the post-installation inspection reports and tracking systems. The IOUs should properly document and record project descriptions, savings, project cost, including, where relevant, incremental cost.
- Baseline specification, documentation and recording – early retirement, replace on burnout, natural replacement and add-on measure, for example – should be an area for concentrated IOU improvement.

1.4.3 IOU Project Baseline Specification

- ED is now working with the IOUs through the ex-ante review process to improve this and other within-program practices pursuant to Decision D 11-07-030. The project-specific baseline specifications applied in this evaluation and in the 2006-2008 program cycle should be reviewed, and serve as a model for improved IOU baseline determination.

1.4.4 IOU Project Impact Estimation and Modeling

- The IOUs should work with ED to improve impact estimation approaches and requirements for whole-building and MBCx projects. This effort would highlight strategies to reduce inaccuracies through application of best and acceptable practices, resulting in more accurate and defensible tracking system impact estimates.
- For projects involving simulation models the IOUs should provide the final version of the energy model and should clearly identify the version of the simulation tool used.

1.4.5 IOU Project Verification

- On-site verification is an important tool which should be applied in an optimized fashion by the IOUs. There are project characteristics, customer characteristics and other factors that should be used by the IOUs to assess risk and trigger on-site verification.

1.4.6 Lower Rigor Assessment Evaluation

- Future low rigor assessments should consider implementing a more detailed and comprehensive review process involving desk review, phone interviews, and possible on site visits for a statistically robust sample.

1.4.7 Program Markets

- If not already discontinued, PG&E is strongly encouraged to discontinue incenting POCs on new oil wells for large companies as an energy efficiency measure, which clearly is standard practice.
- Further investigation is needed into NTGR findings for relevant projects in markets with high free ridership to assess whether decisions have already been made before the program becomes involved, and/or whether other drivers of free ridership/standard practice are present (such that some of the installed measures are becoming standard practice).
- Following completion of the market assessment activities, these findings should be integrated into program plans and designs.

2

Introduction, Purpose and Methods

2.1 Introduction

This report presents interim findings from the impact evaluation of 2010-2012 California investor-owned utilities' (IOUs) custom energy efficiency projects. More than 100 utility programs include custom, non-deemed projects. This evaluation effort investigates those custom measures and offerings across all IOU programs. Observations about programs with a large number of completed sample points (primarily through the net-to-gross (NTG) sample and the Lower Rigor Assessments)[11] are also included in this evaluation. This effort is managed by the California Public Utilities Commission's (CPUCs') Energy Division (ED) and is referenced as Work Order Number 33 (WO033) on the CPUC ED public documents website.[12] The Custom Impact WO033 Evaluation Plan[13] was finalized on December 27, 2011 and provides additional detail on the following:

- Goals, Objectives and Researchable Issues;
- Overview of Programs and Measure Groups;
- Evaluation Data Sources;
- Coordination and Communication;
- Integration with WO002 (Ex-Ante Review);
- Communication and Feedback to IOUs;
- Sample Design;[14]
- Impact Methods (Gross, Net and Lower Rigor); and
- Timeline, Work Plan and Budget.

[11] Lower Rigor Assessment was performed on a number of programs / program groups. The rationale for this specific activity is described later in this chapter and more fully in the WO033 Evaluation Plan and Addenda.

[12] http://www.energydataweb.com/cpuc/home.aspx

[13] http://www.energydataweb.com/cpucFiles/pdaDocs/814/WO33%20Research%20Plan%20Final%2012%2029.pdf

[14] See the Custom Impact WO033 BD Period Sampling Addendum 2010-2012 Impact Evaluation of November 17, 2011 (available at http://www.energydataweb.com/cpuc/home.aspx)

The scope of work for the evaluation of custom measures includes an ex-post estimation of gross and net savings along with associated findings and recommendations that can be used to improve program and measure effectiveness.

The custom impact evaluation is organized into two periods to address the effect on custom program implementation of the CPUC's ex-ante-related Decision (D. 11-07-030).[15] These interim findings address the first of these periods, the 'before-decision' (BD) period. This period includes all of 2010 and Q1 / Q2 2011.

The programs included in the Custom Impact Evaluation primarily address industrial and manufacturing facilities, water supply and treatment and wastewater treatment, oil and gas extraction, oil refining and production, and commercial custom, non-deemed program offerings (including the Savings by Design new construction program). The scope addresses nonresidential custom measures of all types with one exception: lighting measures are generally excluded,[16] except where an IOU project examines whole building – for example, in commercial new construction projects. Commercial deemed savings measures are also present in the custom population, with a concentration in electric refrigeration measures applicable to grocery stores and several gas measures, including steam traps. Deemed measures, however, are not explicitly being addressed in this evaluation. Each custom-oriented program offers one or more of the following interventions in order to encourage end users to upgrade to energy efficient measures: site specific facility assessments, feasibility studies, project incentives, facility audits, pump testing, and specialized training. For a more detailed description of the custom programs or measures, please refer to the Custom Impact WO033 Evaluation Plan previously referenced in this chapter.

2.2 Goals and Objectives

The overarching goals and objectives of this impact evaluation for custom measures and programs with a custom component are: to verify and validate the energy efficiency savings claims reported from IOU energy efficiency programs; to provide feedback on how well program procedures and savings calculation methods align with the CPUC's energy efficiency policies, requirements, and expectations; and to provide recommendations on how custom programs can be improved or refined. Gross energy savings, free ridership levels, and net energy savings (in kWh, kW and therms) are estimated and compared to IOU savings claims using evaluation-based

[15] These two periods are referred to as "before-decision" (BD) and "after-decision" (AD). The before-decision (BD) period includes the program cycle period prior to D. 11-07-030; the after-decision (AD) period refers to the remainder of the program cycle. The decision is located at:

http://docs.cpuc.ca.gov/published/FINAL_DECISION/139858.htm

[16] Custom lighting measures are addressed by WO029.

realization rates. These results and findings are provided to the IOUs along with recommendations on how custom programs can be improved or refined.

More details on the evaluation priorities[17] and the researchable issues for this effort are contained in the Custom Impact WO033 Evaluation Plan referenced earlier in this chapter.

2.3 2010 and 2011 (Q1 and Q2 only) Claimed Energy Impacts

The importance of the WO033 custom impact evaluation effort is due to both the size of the savings claimed through the IOUs' custom energy efficiency efforts and the uncertainty[18] of savings estimates of custom measures. Energy savings claims from the custom measures included in this interim report represent a significant contribution to the overall savings portfolio for the IOUs' energy efficiency programs (about 14% of electric savings claims and 56% of gas savings claims for 2010 and Q1 / Q2 2011 on a statewide basis).

2.3.1 Sample Frame Impacts Relative to Portfolio Accomplishments and Goals

Details regarding the allocation of measurement and verification (M&V) and NTG sample points can be found in the Custom Impact WO033 BD Period Sampling Addendum (November 17, 2011).[19] Table 2-1 and Table 2-2 present the sample frame of claimed accomplishments by utility and fuel domain through Q2 2011, and examine the size of those impacts relative to portfolio accomplishments through Q2 2011 and filed portfolio goals for the 2010-12 program cycle. For both time periods, sample frame accomplishments are expressed as a percentage of portfolio accomplishments and goals.

[17] These priorities include energy savings, load shapes, net to gross ratios and program assessments.

[18] Uncertainty in energy savings stems from a lack of data, changes in operating conditions, and the use of an appropriate baseline. In the evaluation itself, there is also sampling uncertainty related to the representativeness of the sample in relation to the population for any domain.

[19] Available at http://www.energydataweb.com/cpuc/home.aspx

Table 2-1: WO033 Sample Frame Impact Size Assessment – Electric

Fuel	Utility	BD Period WO033 Custom Sample Frame					Portfolio Savings	
		WO033 Custom Positive Electric Energy Savings (MWh)	Percent of Utility Portfolio Electric Savings	Percent of Total Portfolio Electric Savings	Percent of Utility Portfolio Electric Savings Goals 2010-2012	Percent of Total Portfolio Electric Savings Goals 2010-2012	Positive BD Period Electric Savings (MWh)	Electric Savings Goals 2010-2012 (MWh)
Electric	PG&E	455,188	16.20	7.56	14.64	6.53	2,810,535	3,110,000
	SCE	319,894	11.33	5.31	9.65	4.59	2,823,112	3,316,000
	SCG	0	0.00	0.00	-	0.00	4,439	0
	SDG&E	86,541	22.72	1.44	16.03	1.24	380,964	540,000
Total Electric	All	861,623	-	14.31	-	12.37	6,019,051	6,966,000

Table 2-2: WO033 Sample Frame Impact Size Assessment – Gas

Fuel	Utility	BD Period WO033 Custom Sample Frame					Portfolio Savings	
		WO033 Custom Positive Gas Energy Savings (Therms)	Percent of Utility Portfolio Gas Savings	Percent of Total Portfolio Gas Savings	Percent of Utility Portfolio Gas Savings Goals 2010-2012	Percent of Total Portfolio Gas Savings Goals 2010-2012	Positive BD Period Gas Savings (Therms)	Gas Savings Goals 2010-2012 (Therms)
Gas	PG&E	44,488,929	70.92	40.93	90.98	29.60	62,732,073	48,900,000
	SCE	390,608	3.86	0.36	-	0.26	10,107,891	0
	SCG	14,320,756	45.01	13.17	15.91	9.53	31,816,670	90,000,000
	SDG&E	1,790,462	44.26	1.65	15.71	1.19	4,044,905	11,400,000
Total Gas	All	60,990,755	-	56.11	-	40.58	108,701,539	150,300,000

2.3.2 M&V Sample Size by Sampling Domain

Details regarding the M&V sample size and sampling domain can be found in the Custom Impact WO033 BD Period Sampling Addendum referenced earlier in this chapter. Table 2-3 and Table 2-4 present the WO033 number of sampling units and savings accomplishments for each sampling domain, and the number of M&V points allocated to each domain for the BD period.

Table 2-3: WO033 M&V BD Period Sample Size by IOU and Fuel Domain – Electric

Fuel	Utility	BD Period WO033 Custom Sample Frame			M&V Allocation (N)
		Predominant* Electric Sampling Unit (N)	Positive Electric Energy Savings (kWh)	Positive Electric Energy Savings (Therms)	
Electric	PG&E	3,160	444,660,362	1,566,997	50
	SCE	1,149	319,643,593	319,528	50
	SCG	0	0	0	0
	SDG&E	498	85,152,846	270,468	30
Total Electric	All	4,807	849,456,801	2,156,992	130

Table 2-4: WO033 M&V BD Period Sample Size by IOU and Fuel Domain – Gas

Fuel	Utility	BD Period WO033 Custom Sample Frame			M&V Allocation (N)
		Predominant* Gas Sampling Unit (N)	Positive Electric Energy Savings (kWh)	Positive Gas Energy Savings (Therms)	
Gas	PG&E	266	10,527,750	42,921,932	40
	SCE	6	250,445	71,080	0
	SCG	153	0	14,320,756	30
	SDG&E	34	1,388,724	1,519,995	
Total Gas	All	459	12,166,919	58,833,763	70

* Represents largest share of savings by fuel based on source energy.

Note 1: Sampling unit is generally a unique measure name or application number by site ID. Further refinements are applied using judgment.

2.3.3 WO033 Sample Sizes

Overall sample sizes across IOUs for WO033 for both before decision (BD) and after decision (AD) periods along with the type of sample point[20] can be found in Table 2-5 below. For details regarding the allocation of NTG sample points by program group, refer to the WO033 BD Period Sampling Addendum referenced earlier in this chapter.

[20] Sample points are of three types: (1) M&V points for determining evaluated gross impacts, (2) telephone survey data collection for determining NTGR estimates, and (3) engineering desk review activities for the lower rigor assessment aimed at various programs.

Table 2-5: Summary of Overall Sample Sizes for WO033 Impact-Related Effort

Impact Evaluation Component	Before Decision	After Decision**	Total
M&V Points (Gross Realization-Rates + NTG)	200	400	600
Lower Rigor Points (Qualitative + NTG)	100	0	100
Incremental NTG-Only Points	480	680	1,160
Total*	**780**	**1,080**	**1,860**

* All points incorporate NTG evaluation in addition to gross impact evaluation efforts.

** Some after-decision M&V points will include pre-installation data collection performed under WO002.

Note that this shows the overall or total sample size for WO033 in the before decision (BD) period. This table is provided for context of the entire evaluation effort. Not all of the targeted sample points have been completed at this time. Results in this interim report are based on the actual number of completed surveys to date, as noted below and in the results sections.

2.4 Study Methods

Gross savings, free ridership and net savings (kWh, kW and therms) are estimated using evaluation-based gross realization rates and NTG ratio estimates. The Custom Impact WO033 Evaluation Plan includes details on the study methods for gross, net, and lower rigor activities, and is guided by the following:

- *California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals*[21]*;*
- *The California Evaluation Framework;*[22] and
- *Procedures for Site-Specific Impact Analysis under Work Order WO033.*[23]

2.4.1 Gross Energy and Demand Impact Evaluation

The custom measure gross energy impact assessment involves standard EM&V approaches, including on-site data collection, monitoring, and analysis for a representative sample of custom measures, measure groupings and programs to: a) develop ex-post estimates of the energy and demand savings for each project in the sample, and b) apply those findings back against the full participant population to obtain a complete estimate of program impacts. For additional details on gross impact methods used, refer to the Custom Impact WO033 Evaluation Plan and the *Procedures for Site-Specific Impact Analysis under Work Order WO033* referenced earlier in this report.

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21 Available at: www.calmac.org/publications/EvaluatorsProtocols_Final_AdoptedviaRuling_06-19-2006ES.pdf

22 http://www.calmac.org/publications/California_Evaluation_Framework_June_2004.pdf

23 This document was developed by Itron and KEMA and is posted at: http://www.energydataweb.com/cpuc/home.aspx

This interim report includes gross impact results and findings from 99 completed gross impact EM&V projects out of a total of 200 projects that are included in the BD sample. Site specific evaluation reports are being completed for each of those projects. The remaining 101 BD gross impact sample points are not yet complete and will be incorporated into future evaluation reports for Work Order 33.

2.4.2 Lower Rigor Evaluation Activities

Additional site level evaluation efforts are conducted using lower rigor points. Lower rigor assessment conducted for these points, as described in greater detail in the Custom Impact WO033 Evaluation Plan, expands the reach of the evaluation to programs that would not receive much attention based on M&V sample allocation alone. The lower cost per point enables the evaluation of a larger proportion of the IOUs' portfolios than if only standard rigor M&V points were included. This activity supports investigation of the various strengths and weaknesses of specific IOU programs and program groups. In this effort, lower rigor point assessments consist of desk reviews of ex ante project application files. Adherence to program rules and quality of information and savings calculations were the focus of the lower rigor project assessments.

A total of 100 lower rigor assessments for 'lower rigor only' points complement the lower rigor assessments that are also being conducted for the M&V points. Combined the lower rigor points provide coverage over a large number of programs and program groups. Detailed analysis of energy savings is not included in the scope of the lower rigor assessment. As noted, this evaluation effort is described in more detail in the Custom Impact WO033 Evaluation Plan. Chapter 5 of this report provides results to date for the lower rigor assessment.

2.4.3 Net Energy and Demand Impact Evaluation

The NTG evaluation assessment uses telephone survey data collection and self-report methods to derive net program impacts. A non-residential NTG guidance team composed of ED staff, contractors and consultants developed general approaches for use by 2010-2012 energy efficiency program evaluations. More information regarding the NTG assessment and methods used can be found in the Custom Impact WO033 Evaluation Plan referenced earlier in this chapter.

This interim report includes net to gross impact results and findings from a large number of completed net to gross surveys covering 604 of 780 projects that are in the BD sample. However, the telephone survey completion rate does not yet fully support the original sample size. Approximately 10 additional interviews for projects in the BD period will be conducted. These are important large projects, and, following the completion of those interviews, the resulting sample should capture the majority of savings while representing the underlying program groups, as designed. Chapter 4 of this report provides results to date for the net impact assessment.

3

Gross Impact Results

This chapter presents quantitative and qualitative gross impact results for the BD period of the 2010-2012 WO033 custom impact evaluation.

This chapter includes the reporting of gross realization rates. Gross realization results are presented for energy efficiency projects on an unweighted basis with means and frequencies presented across sampling domains, which are composed of IOU and fuel combinations. Sampling domains are defined in the WO033 research plan.[24] Briefly, these domains include five combinations of IOU and fuel: PG&E electric, PG&E gas, SCE electric, SDG&E electric, and SCG / SDG&E gas. These domains are fully described in the BD Period Sampling Addendum to the research plan, dated 11/17/2011 and publicly posted on the CPUC ED public documents website.[25]

3.1 Participation Patterns

During the first six quarters of the 2010 – 2012 program cycle, PG&E and SCE projects together accounted for the majority of statewide ex-ante electric savings attributed to the custom impact projects assigned to WO033 (92% together, 59% for PG&E and 33% for SCE). PG&E and SCG projects accounted for the majority of statewide natural gas savings attributed to WO033 (96% together, 68% for PG&E and 28% for SCG). The core IOU programs account for the majority of WO033 savings, but several larger third party/non-core programs also contribute significantly to the portfolio. These are primarily three non-core programs:

- Energy Efficiency Services for Oil Production program - PGE2222;
- Heavy Industry Energy Efficiency Program - PGE2223; and
- Local Non-Residential (BID) Program – SDG&E3117.

24 http://www.energydataweb.com/cpucFiles/pdaDocs/814/WO33%20Research%20Plan%20Final%2012%2029.pdf

25 http://www.energydataweb.com/cpuc/home.aspx

3.2 Site-Specific Gross Impacts Summary

In this sub-section, project specific unweighted gross impact results are presented by stratum at the IOU/fuel domain level.

Gross impact evaluation results are shown for 99 sites that have been analyzed (to date), including the reasons for differences in impact estimates between the evaluation results and the IOU ex-ante claims. Gross impact results for the remaining 101 points in the BD gross impact sample are currently being compiled and will be reported on in the final report for the program cycle. A complete M&V plan and an impact evaluation report were developed for each site. ***Note that for the 99 completed sites, M&V findings should be considered draft only and are subject to further review and revision, in particular with regard to final ex-post savings and realization rates.***

Results demonstrating how frequently a given reason accounted for the difference between ex-ante and evaluated savings in the sample are also provided in this section.

Figure 3-1 and Figure 3-2 graphically presents ex-post versus ex-ante savings estimates for the entire sample. These figures present the ex-ante (tracking system) and ex-post evaluated savings for the entire sample, for kWh and therms, respectively. The charts also include a unity line, which divides the results into those in which the site-specific realization rates were above one (sites above the line) and below one (sites below the line). The outliers with realization rates above 300% or below -300% were excluded for readability. The figures show the majority (95%) of sites. A total of six outliers were removed. The distribution was as follows: two from the PG&E electric domain (one affecting kWh only and both affecting kW), three from the PG&E gas domain (all with gas realization rates above 300%), and one from the SCE electric domain (affecting kW only). A total of seven outlying values have been removed.

Figure 3-1: First-Year Ex-Post and Ex-Ante Savings (kWh) for Completed Sample Projects (without outliers)

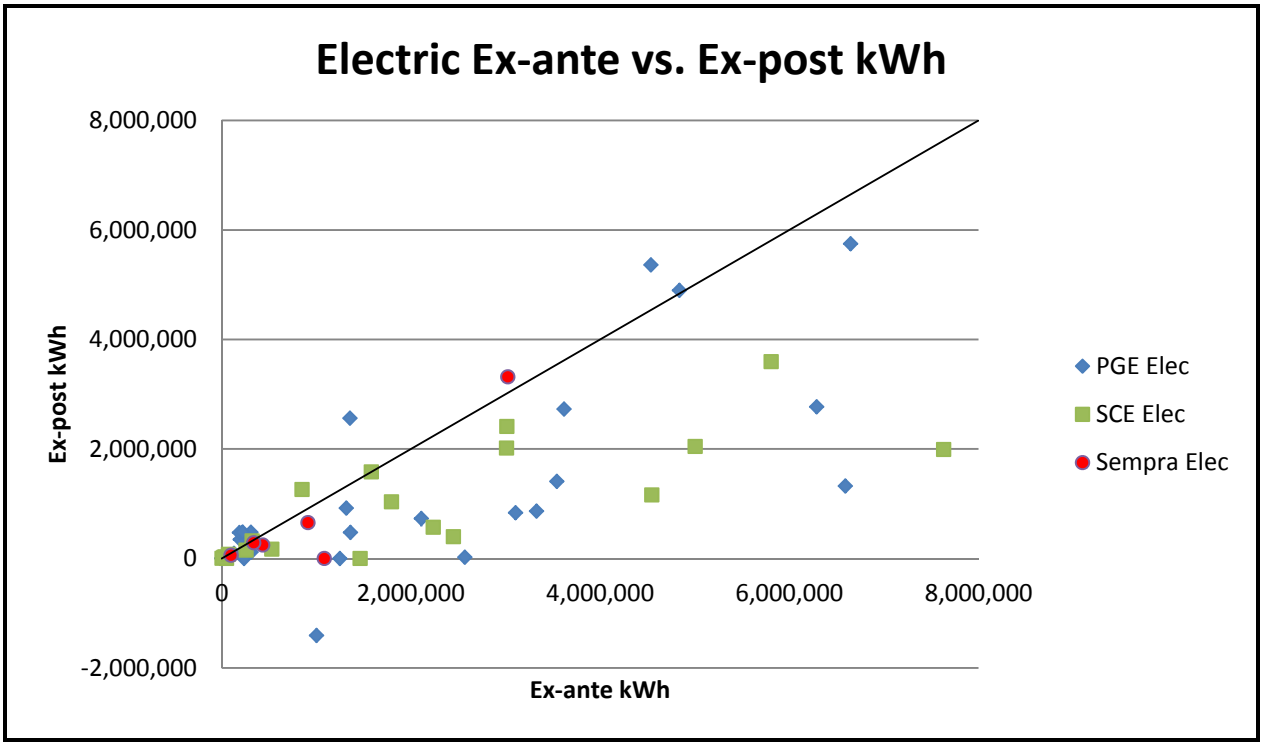
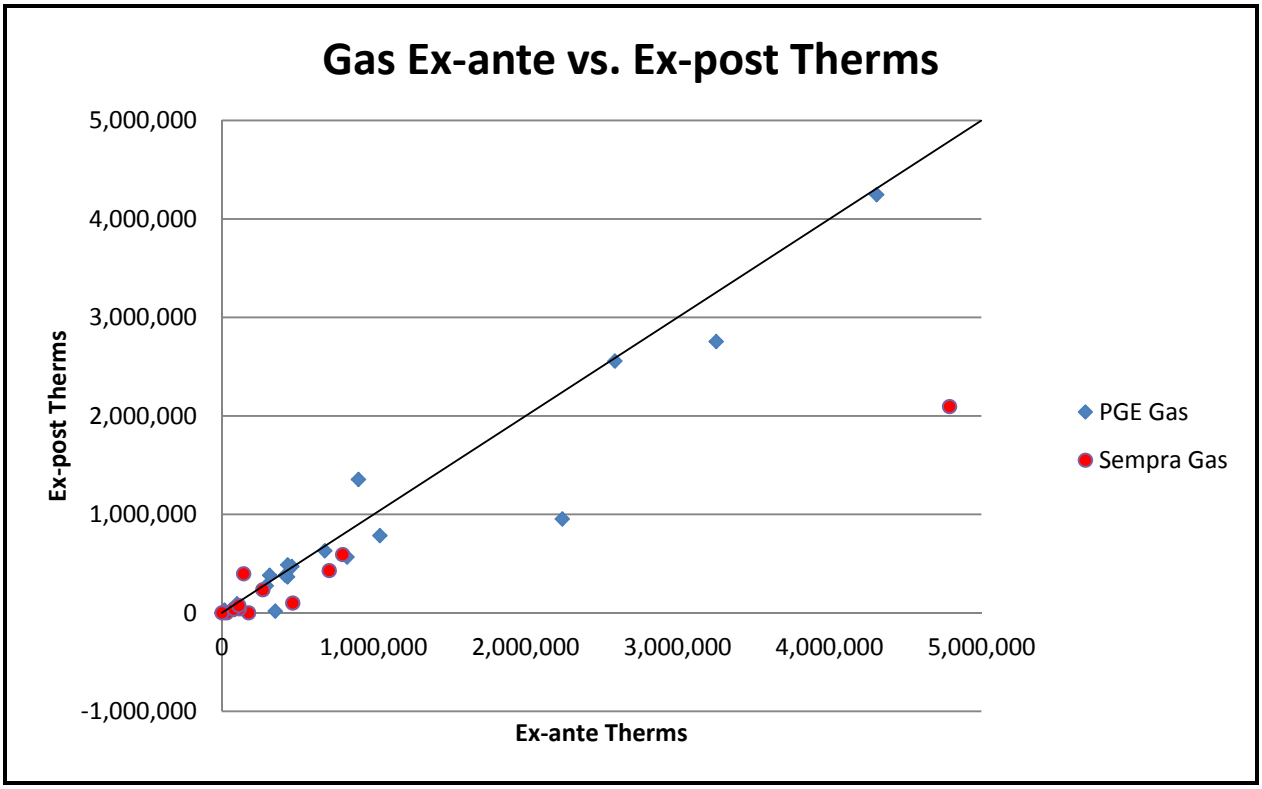


Figure 3-2: First-Year Ex-Post and Ex-Ante Savings (therms) for Completed Sample Projects (without outliers)



It is noteworthy that therm ex-post evaluation estimates to date are in closer alignment with h the ex-ante estimates, especially for PG&E. This has not been the case in past evaluations, and appears to represent a notable improvement in IOU accuracy for this important fuel domain. However, a relatively small number of large projects are represented at this time, so the final results from the BD period may or may not confirm this improvement. For electric projects, the ex-post impacts are trending low for all projects, particularly the larger projects.

Table 3-1 presents realization rates across the five sample domains discussed in the research plan. The unweighted mean realization rate is shown for kW, kWh and therms as a separate row for each domain, along with the instances where the realization rate is higher than 125%, lower than 0% (signifying an energy penalty), and equal to 0% (signifying no energy savings). The total number of sample points planned by domain and the total number of completed M&V points are also shown for the fuel type (electric kWh or gas therms) on which the sample was selected.

Table 3-1: Realization Rates Across Sample Domains and Energy Metric (kWh, kW, and therms) – All Completed Sample Points

Sample Domain	Sample Count	Complete Count	Percent Complete	With All Completed Points			
				RR Mean	RR > 125%	RR = 0%	RR < 0%
PGE Electric							
kWh*	50	31	62%	0.523	6	3	2
kW	-	26		0.504	3	1	2
PGE Gas							
Therms*	40	29	73%	1.357	7	0	1
SCE Electric							
kWh*	50	21	42%	0.609	1	2	0
kW	-	20		0.802	3	3	0
SDGE Electric							
kWh*	30	6	20%	0.604	0	1	0
kW	-	4		0.720	1	1	0
SDGE and SCG Gas							
Therms*	30	12	40%	0.588	1	1	0

* Primary sample was designed and selected at this level.

Table 3-2 presents unweighted realization rates across sample domains with the most extreme cases (those with very high or very low realization rates) removed. For this table, sample points with a realization rate value of greater than 300% (or less than 300%) were removed from the mean realization rate calculations. This operation was performed to minimize the effect of projects with extreme realization rates to show the average, unweighted values for the majority of projects. The effects of these more extreme ratio results will be clearer once the full sample is complete and strata weights are applied in the final report.

Table 3-2: Realization Rates Across Sample Domains and Energy Metric (kWh, kW, and therms) – Excludes Most Extreme Points (Outliers)

Sample Domain	Sample Count	Complete Count	Percent Complete	Without Extremes (RR>3 or RR<-3)			
				RR Mean	RR > 125%	RR = 0%	RR < 0%
PGE Electric							
kWh*	50	30	60%	0.744	6	3	1
kW	-	24		0.670	2	1	1
PGE Gas							
Therms*	40	26	65%	0.766	4	0	1
SCE Electric							
kWh*	50	21	42%	0.609	1	2	0
kW	-	19		0.613	2	3	0
SDGE Electric							
kWh*	30	6	20%	0.604	0	1	0
kW	-	4		0.720	1	1	0
SDGE and SCG Gas							
Therms*	30	12	40%	0.588	1	1	0

* Primary sample was designed and selected at this level.

Table 3-3 presents the primary reasons for the realization rate discrepancies across the sample domains. It is noted that the sample sizes for SCE, and especially for SCG and SDG&E, are small, and the results should be considered illustrative of the primary reasons that were found for savings gaps between ex-ante and ex-post results. Differences in operating conditions were found to be most significant, while baseline issues – improper baseline selection for systems or improper baseline specification for operating parameters – was highlighted as primary reasons for many projects. These are discussed in more detail in the chapter on findings and recommendations.

Table 3-3: Primary Reasons for Discrepancies in Realization Rates Across Sample Domains – All Completed Sample Points

Sample Domain	Project Count	Operating Conditions	Inappropriate Baseline	Calculation Methods	Equipment Specification	Ineligible Measure	Measure Count	Tracking Database Discrepancy
PG&E Electric	31*	19	6	2	1	1	0	0
PG&E Gas	29	16	6	4	1	1	1	0
SCE Electric	21*	9	3	4	1	2	1	0
SCG / SDG&E Gas	12	7	4	0	0	1	0	0
SDG&E Electric	6	4	0	1	0	1	0	0

* Project count does not match totals of discrepancy factors as some sites had no primary reason for the discrepancy.

Table 3-4 presents the primary reasons for the realization rate discrepancies across the sample domains with the most extreme points (outliers) excluded.

Table 3-4: Primary Reasons for Discrepancies in Realization Rates Across Sample Domains – Excludes Most Extreme Points (Outliers)

Sample Domain	Project Count	Operating Conditions	Inappropriate Baseline	Calculation Methods	Equipment Specification	Ineligible Measure	Measure Count	Tracking Database Discrepancy
PG&E Electric	29*	18	5	2	1	1	0	0
PG&E Gas	27	15	6	3	1	1	1	0
SCE Electric	20*	8	3	4	1	2	1	0
SCG/ SDG&E Gas	12	7	4	0	0	1	0	0
SDG&E Electric	6	4	0	1	0	1	0	0

* Project count does not match totals of discrepancy factors as some sites had no primary reason for the discrepancy.

Table 3-5 presents impact results by size strata for each sample domain. There are five strata, based on size of claimed ex-ante energy savings, with strata 1 projects claiming the largest savings and strata 5 projects claiming the smallest savings. As noted on other tables, sample sizes are small and are illustrative of trends within the various sample domains.

Table 3-5: Realization Rate by Strata Across Sample Domains (All Completed Sample Points)

Strata in PGE Electric Domain	Project Count	RR Mean kW	RR mean - kWh	RR mean - therms	RR > 125%	RR = 0%	RR < 0%
1	9	0.67	0.58	na	0	0	0
2	4	1.06	0.72	na	1	0	0
3	4	-1.51	-1.53	na	0	0	2
4	7	1.17	1.26	na	4	0	0
5	7	0.64	0.76	na	1	0	0
Strata in PGE Gas Domain	**Project Count**	**RR Mean kW**	**RR mean - kWh**	**RR mean – therms**	**RR > 125%**	**RR = 0%**	**RR < 0%**
1	0	na	na		0	0	0
2	1	na	na	0.99	0	0	0
3	4	na	na	0.75	0	0	0
4	10	na	na	0.92	2	0	0
5	14	na	na	1.87	5	0	1
Strata in SCE Electric Domain	**Project Count**	**RR Mean kW**	**RR mean - kWh**	**RR mean – therms**	**RR > 125%**	**RR = 0%**	**RR < 0%**
1	4	0.46	0.42	na	0	0	0
2	4	0.57	0.47	na	0	0	0
3	4	1.62	0.73	na	1	0	0
4	3	0.63	0.61	na	0	0	0
5	6	0.70	0.75	na	0	0	0

Table 3-5 (Cont'd): Realization Rate by Strata Across Sample Domains (All Completed Sample Points)

Strata in SCG/SDGE Gas Domain	Project Count	RR Mean kW	RR mean - kWh	RR mean - therms	RR > 125%	RR = 0%	RR < 0%
1	1	na	na	0.44	0	0	0
2	2	na	na	0.67	0	0	0
3	3	na	na	1.27	1	0	0
4	5	na	na	0.29	0	0	0
5	1	na	na		0	0	0
Strata in SDG&E Electric Domain	**Project Count**	**RR Mean kW**	**RR mean - kWh**	**RR mean - therms**	**RR > 125%**	**RR = 0%**	**RR < 0%**
1	1	1.48	1.10	na	0	0	0
2	2	0.35	0.36	na	0	0	0
3	1		0.66	na	0	0	0
4	1		0.54	na	0	0	0
5	1	0.70	0.61	na	0	0	0

The tables and figures in this chapter were developed from the site specific M&V evaluation results for 99 projects. Summary evaluation-related characteristics of these projects are provided in Appendix A and Appendix B. Appendix A contains the following: the type of measure and site, the strata and fuel type, the gross realization rates, and the primary and expanded reasons for the savings discrepancy for the evaluated project. A mapping of Itron Site ID Numbers to ED Claim IDs / IOU Application Numbers, ex-ante energy savings from the IOU tracking systems, evaluated ex-post energy savings, strata / fuel type, and measure/site type is shown in Appendix B.

3.3 Descriptions of Selected Projects

Short descriptions for selected projects are provided on the following pages. These project summaries are meant to illustrate further the types of issues found with projects that lead to savings estimations both in agreement with the evaluation team findings and those that vary from what the evaluation team found based on M&V site visits and activities. Additional case studies are presented in Appendix G.

Site E007 – Changes to Mineral Bleaching Process for a Chemical Manufacturer - Therm GRR 43%; Operating Conditions and Calculation Method Difference

One of the two line trains expected to be decommissioned was still operational, and was still being utilized. The line train retrofit used a newer type of process (chemically based inputs versus energy based inputs) that was being tested and utilized on an experimental basis at the time of the evaluation. The measure for the second line train was not installed, operational and in use at the time of the site visit, leading to the low realization rate.

Site E010 – Install Hot/Cold Aisle Configuration in a Data Center – kWh GRR 44%, kW GRR 44%; Issues with Incorrect Baseline: Operating Conditions and Measure Counts

The project implemented a hot/cold aisle airflow configuration at their data center. This arrangement directs air from isolated cold aisles through servers to hot aisles and allows the data center to operate at higher supply/return air temperature differences, which reduces the airflow requirements of the air handler units (AHUs) serving the data center. By running at lower airflow rates, the facility also reduces the static pressure drop through their duct systems relative to baseline. Savings are therefore realized by reducing the fan load relative to baseline conditions in each of the 75 air handlers affected by this measure. The evaluation team utilized metered AHU power data, EMS drive speed trends, EMS supply and return temperature trends, and data from the original TAB report to assess energy use for the installed case. The primary reason for this poor realization rate is due to the incorrect total static pressure baseline that was utilized in the IOU's savings estimate. The appropriate baseline is 1.9 in WG (inches water column) based

on standard practice in data centers, whereas 3.5 in WG was used in ex-ante baseline calculation. Additionally, 53 AHUs were operating as compared to 75 AHUs.

Site E016 – New Construction Project for Greenhouse – kWh GRR 16%, kW GRR 4%, Therm GRR 93%; Calculation Method Difference

For this greenhouse project using the eQuest building simulation model, metered data showed lower greenhouse interior temperatures and smaller gas savings; changes in baseline construction increased ex-post savings, offsetting some of the decreases from lower temperatures.

Site E031 – Municipal Authority Water Pumping Application – kWh GRR 14%, kW GRR 112%; Operating Conditions Difference: Incorrect Forecasting

At this large pumping operation, the hours of operation were significantly less than used in ex-ante calculations, which forecasted over a long (5 year) future timeframe. SCADA data for flow and VFD speeds were used in the ex-post calculations, as opposed to estimated flow and speed in the ex-ante calculations.

Site E041 – Compressed Air System Modifications – kWh GRR 1%; kW GRR 1%; Operating Conditions Difference: Control System Unable to Achieve Predicted Savings

This project involved the modifications to an existing compressed air system including new piping, additional storage, flow controller, new compressor controls, and pressure adjustments. A 400 HP air compressor and a 450 HP air compressor were affected by this project. The key assumption in the IOU ex-ante analysis was that, after the project was implemented, only the 400 HP compressor would be required to operate. The evaluation team's analysis of the ex-post data provided by the customer shows that both the 400 HP and 450 HP compressors operated more than 99% of the time, similar to the compressor operation before the project was implemented. The customer stated that production levels have not changed significantly since the project was completed.

Site E054 – Wastewater Treatment Plant Retrofits (New Dissolved Oxygen System, Efficient Blowers, VFDs) – kWh GRR 63%, kW GRR 74%; Issues with Baseline

For this treatment plant, the largest contributor to driving the ex-post savings to lower than the ex-ante savings is the inappropriate baseline. The dissolved oxygen (DO) system that was replaced was an efficient fine bubble system. The ex–ante calculations used a course bubble system, which is less efficient and not widely in use for retrofit projects. A regressive baseline - which is less efficient than the pre-existing system – was used to calculate savings.

Site E056 – Pump Replacement – kWh GRR 0%; kW GRR 0%; Operating Conditions Issue: Pump Not Operating

This project involved the replacement of an oversized pump with a more correctly sized pump. The evaluation team's ex-post evaluation found that the new pump was installed at the end of March 2011. The new pump went out of service in mid- January 2012, and was not operating at the time of the site visit in May 2012. The customer had no firm date for the repair of the pump. The larger, oversized pump (that was not removed as typically required) was operating at the time of the evaluation team's site visit. Further investigation is needed to determine if the customer obtained IOU authorization to retain the older, replaced pump.

Site E057 – New Gas Compressors – kWh GRR -611%; kW GRR – 611%; Baseline Issue

This project involved the replacement of existing internal combustion engine driven natural gas compressors with rebuilt compressors powered by new electric motors with VFDs. The internal combustion engines were supplied with fuel produced locally in an oil field and with non-IOU supplied natural gas. ***This project has a gross realization rate of -611% for kWh and -611% for kW, signifying that this project actually increased electrical energy use and increased grid impacts, without any accompanying IOU-provided natural gas reduction.*** The evaluation team has found that the IOU has used an incorrect baseline for this project. The evaluation team views this project as a fuel switching project. The evaluators found that natural gas is available at the location only from non-IOU sources. Therefore, the evaluation team considers this project as having added load to the grid. Accordingly, negative kWh and kW impacts (an energy penalty) have been assessed.

Site E079 – New VFD Chiller – kWh GRR 155%; kW GRR 89%; Calculation Method Issue, Errors in eQUEST Model

This project involved the replacement of a 1,200 ton chiller with a 1,200 ton VFD driven chiller in a central plant with three other similar capacity chillers. The IOU used an eQUEST model to estimate the impacts for the project. ED reviewed the IOU's model and found several discrepancies between the base case and enhanced case models. Some of the issues identified included: different building shell components between models, different chiller capacities for chillers not affected by the project between models, flow and pump heads that did not make sense in either model, and a lack of specifying chiller sequencing in either model. ED corrected the model deficiencies and used ex post data from the new chiller control panel to estimate the impacts for this project.

Site E089 – Hotel Laundry Ozone Retrofit – Therm GRR 12% – Operating Conditions Issue

A smaller commercial laundry system was retrofit with an ozone system to reduce hot water usage. The site visit revealed that the operators did not reduce hot water use but instead used both ozone and hot water. This project highlights the importance of post-installation inspections and documentation of correct usage of installed measures.

Site E123 – Compressed Air System Modification – kWh GRR 0%; kW GRR 0%; Baseline issue: IOU Incorrect Baseline Adjustment after Implementation

This project involved the installation of an intermediate flow controller for compressed air system. The evaluation team found that the IOU incorrectly adjusted the project baseline for the post installation savings calculations after implementation was completed but before the final submission of energy savings for an incentive. The adjustment was from 106 psig to 120 psig for the baseline pressure. No basis for this adjustment was provided. The system operating pressure before and after the project was implemented were approximately the same, resulting in no savings for this project.

Site F024 – Compressed Air System Modifications – kWh GRR 26%; kW GRR 24%; Baseline issue: IOU Used Incorrect Data to Establish Baseline

This project involved the modifications to an existing compressed air system including new centralized controls, no loss condensate drains, dust collection system modifications, reduction to system air pressure, and various compressed air demand reduction measures. The evaluation team's ex-post evaluation found that while the new control system was installed, many of the other measures had not been implemented. Additionally, the evaluation team's review of the ex-ante baseline revealed that IOU baseline data were collected for unusually short measurement periods. This review also found that the baseline analysis of field collected data performed by the IOU does not agree with data that the evaluation team collected from the customer's SCADA system for the same time frame. This baseline discrepancy accounts for most of the difference in savings impacts between the IOU reported values and the evaluation team's assessment of the gross impacts.

Site F042 – Agricultural Pump Rehabilitation – kWh GRR 24%; Baseline / Operating Conditions Issue: IOU Used Very Inefficient Excessively Vibrating Pump as Baseline

This agricultural pumping project involved the rehabilitation of a 250 hp pump. This project has a realization rate for kWh of about 40% and 42 kW of demand savings while the IOU claimed 0 kW savings. It is unknown why no kW savings were claimed in the IOU tracking database and why there were two records with two different IOU/ED claim IDs in the IOU tracking database.

The pump that was replaced was vibrating badly during its pump test, and this abnormal condition was used to calculate kWh savings. The project suffered from a poor baseline, a difference in operating conditions, and possibly a tracking system discrepancy. The calculation method used by the evaluation team was typical for pump testing projects but different than the IOU submitted calculations.

Site F050 – Compressed Air System Modifications – kWh GRR 100%; kW GRR 100%; No Issues Identified

This project involved the modifications to an existing compressed air system including a new VFD driven compressor and sequencing controller for the compressed air system. ED's ex post evaluation found that the IOU's AIRMaster+ analysis was correctly performed based on measured compressor data and adjusted for the AIRMaster+ minimum efficiency baseline as required by the program guidelines.

Site G004 – Citrus Juice Evaporator – Therm GRR 21%; Baseline Issue: IOU Used Unrealistic, Non-ISP Baseline

This project involved the installation of a new citrus juice evaporator, boiler, boiler controls and heat recovery systems. The evaluation team's evaluation focused on the citrus juice evaporator measure (80% of the total savings claim).The evaluation team interviewed the equipment supplier for this project and determined that the IOU's claimed baseline is not current industry standard practice (ISP) for a citrus juice evaporator. The evaluation team adjusted the baseline and recalculated the impacts using production data from the customer. The baseline adjustment significantly reduced the savings impacts for this project.

Site G026 – Process Boiler – Therm GRR- 46.6%; Inappropriate Baseline Issue

Four measures were incentivized as part of this project: 1) a burner retrofit on a pre-existing boiler, 2) water treatment process improvements to reduce boiler blow down, 3) installation of a new heat exchanger to preheat process water with wastewater streams, and 4) installation of a 99.7% (not a typo) efficient hot water heater to reduce the load on the steam boiler. The IOU analysis first parsed out the facility's gas loads among its primary gas using equipment (boiler, gas dryers and dry cleaning equipment). This was done by assuming various operating hours and load factors for the equipment, and then scaling the estimates to match annualized utility billing data. The evaluation team performed combustion tests on both the new hot water heater and the new boiler. The difference between the ex-ante and the ex-post savings is primarily due an inappropriate baseline; the burner was not replaced and the boiler does not operate nearly as inefficiently as specified. The evaluation team used different methods to estimate loads (boiler and hot water heater) and energy savings than did the IOU. Additionally, the heat exchanger measure operated at a 17°F delta-T as opposed to 36°F as projected in the IOU analysis.

Site H013 – Garage Fan Ventilation System – kWh GRR 0%; kW GRR 0%; Ineligible Measure Issue

This project was an installation of a garage demand control (CO) ventilation system to control the operation of the exhaust fans. The customer parking garage has an existing CO monitoring system that is in failure mode (i.e., fans on in manual mode). The project involved installing new carbon monoxide (CO) controllers and sensors that control the operation of the exhaust fans, instead of the fans being manually controlled. The measure was considered ineligible by the evaluator based on the condition of the pre-existing equipment.

The detailed file review and site visit determined that there was a pre-existing CO monitoring system that was in "failure mode". This project was applied for under the 2009 Interim Energy Savings Bid (ESB – SDGE3117) program. Per the 2010 ESB policy manual, Section 1.5 *Qualifying Projects,* "All energy-efficiency measures must be retrofits or replacements of existing equipment. The equipment that is being replaced cannot be broken and must still be in operation…."

Site H032 – NRNC Savings By Design Whole Building In a Large Office Building – kWh GRR 66.1%; Therm GRR 3540%; Operating Conditions Issue

This was a new six-story building project involving the installation of: (1) a cool roof; (2) high performance glazing; (3) high efficiency lighting; (4) occupancy sensors; (5) high efficiency package and split AC units with economizers and VSD fans; (6) cooling tower VFD; (7) condenser water and heating hot water pump VFD; and (8) high efficiency HHW boilers. The project claimed savings of 17.2% relative to the 2005 Title 24 standard. The IOU used the Energy-Pro modeling tool to estimate the energy savings for this measure. The evaluation team used the ex-ante model, but used a calibrated approach to evaluate the energy savings for this project. The primary reasons for the poor realization rate for kWh were due to changes in: cooling demand, U factor of the glazing, a building schedule, and an actual relief fan power. The ex-post gas savings was determined to be 743 therms per year compared to the ex-ante savings of 21 therms per year. The major reasons behind this substantial increase were due to the combined impact of building location change, building operating schedule change, and building receptacle load reduction. Another factor contributed to the higher gas savings is that the U-factor of the glazing decreased from the ex-ante previous default value of 0.61 to an ex-post value of 0.3~0.5 NRFC.

4

Net-to-Gross

The methodology used to develop the individual, site-specific NTG estimates is summarized in the Evaluation Plan provided previously.[26] Here, we present the weighted results for each sampling domain and for selected programs where the findings are sufficiently robust.[27]

Note that NTG survey data collection is not yet complete. However the number of completed surveys is large enough to present a weighted NTG ratio for nearly every major sampling domain and for numerous programs of interest.

4.1 Number of Completed Surveys and Sampling Points to Date

A substantial number of NTG surveys were completed for each utility. The number of completed surveys varied significantly across the utilities, with the largest number completed for PG&E. There were two reasons for this: (1) PG&E has the largest targeted sample in the Custom/Calculated area; and (2) PG&E had a non-disclosure agreement (NDA) in place with Itron early on, which facilitated the process of confidential customer data exchange and allowed for the completion of interviews with account reps, per NTG interview procedures. Because of this, completions of surveys with PG&E customers were prioritized, from a time sequencing point of view, over those of SCE, SDG&E and SCG customers. Table 4-1 below reports the number of sampled projects by utility represented by all of the surveys completed.

[26] Custom Impact WO033 Evaluation Plan, 2010-2012 Impact Evaluation, Final Draft, October 12, 2011

[27] The criteria for sufficient sample size for presenting interim NTG results for this interim report include one or more of the following: 90/20 confidence and precision, 20 or more completes, or a large share of completes as compared to the population (e.g., for very small populations a small number of completes may be considered sufficient for interim reporting).

Table 4-1: Number of Sampled Projects Represented by Completed Surveys

Utility/Fuel Sampling Domain	Number of Sampled Projects for Completed Surveys (N)
PG&E Electric	278
PG&E Gas	121
SCE Electric	124
SDG&E Electric	44
SDG&E/SCG Gas	37
Total	**604**

4.2 NTGR Methodology

As discussed in the methodology section of the evaluation plan, the calculated NTGR is an average of three scores: Score 1 reflects the influence of the most important of the program and non-program influences in the customer's decision to select the program measure; Score 2 is a relative program influence score that captures the perceived influence of the program relative to non-program factors in the decision to implement the measure; and Score 3 is a no-program score that captures the likelihood of various actions the customer might have taken in the absence of the program. NTGRs can range from a low of 0.00 to a high of 1.00. NTGRs were calculated for each project based on this scoring methodology. To calculate an estimate of the NTG ratio for a sampling fuel domain and program of interest, the individual net-to-gross ratios for each of the surveyed projects in the sample were weighted by the project-specific ex-ante savings and the proportion of the total sampling domain ex-ante savings represented by each sampling stratum. This process was repeated to compute a weighted NTGR for each domain and program of interest for which we had a sufficient number of completed surveys.

4.3 Weighted NTGR Results

The tables below present statistics for the population and NTG sample completes used to develop the final weighted results for each sampling domain and program of interest. Note that the NTG sample is larger than the gross sample because, in addition to gross sampled sites, it also includes a number of 'net-only' sites. For all utility/fuel domains except SDG&E/SCG Gas, a large number of surveys were completed, providing sufficiently robust results across most programs and program groupings. For SDG&E/SCG Gas, a sufficiently large number of completed surveys to support a weighted NTGR calculation for individual programs could not be completed in time for this report, and therefore none is reported.

Weighted NTGRs were also calculated for each size stratum within each program, enabling closer examination of the factors driving program level NTGRs. In some cases, the number of

completed surveys within a stratum was either zero or too small to support a weighted estimate and such cases are noted.

- ***General NTGR Observations***
  - In general, the weighted NTGRs for the **electric fuel domain have not improved as compared to the evaluated values** from the PY2006-2008 evaluations of Industrial programs for both PG&E and Southern California Edison. The NTGRs for most electric programs and program groups in this evaluation range from 0.50 to 0.70 although PG&E programs and certain niche programs experienced much lower NTGRs as discussed below.
  - However, there has been a **significant improvement in the weighted NTGRs for PG&E gas programs** over those seen in the PY2006-2008 evaluations. In that evaluation, the gas NTGR was particularly low (0.31), but has more than doubled for both the PG&E Core Calculated – Industrial and All PG&E Core programs groupings. However, gas projects completed through certain programs such as PGE2225 (Nexant's Refinery Energy Efficiency program) and the Local Government Partnership, PG&E Energy Watch program group, continue to experience high free ridership.

Below is a more detailed summary of program-level NTGR results by utility and fuel domains.

4.3.1 Completed NTG Surveys versus Sample Frame – PG&E Electric and Gas

Table 4-2 summarizes, by Program domain, the total number of projects in the population as of June 30, 2011, the sample design, and the number of completed NTG surveys for the PG&E Custom Electric and Gas populations.

Table 4-2: PG&E Custom Electric and Gas Population, NTGR Sample and Survey Completes

	Population	M&V Sample		Supplemental NTG	Total NTG	NTG Completes		
Program Domain	N	Electric n	Gas n	n Sample	n Sample	Electric n	Gas n	Unique n
All	3,426	50	40	243	333	278	121	344
PGE21011	694	8	6	14	28	40	22	46
PGE21021	122	10	12	6	28	23	18	39
PGE21031	323	4	4	20	28	38	19	49
PGE21035	396	2	0	26	28	29	0	29
PGE21042	168	3	2	23	28	4	1	4
PGE2222	74	10	0	18	28	25	0	25
PGE2223	63	2	2	24	28	10	8	18
PGE2225	10	1	3	6	10	7	3	8
Other 3P PGE Group	890	3	5	20	28	27	15	41
RCx Group	8	0	0	8	8	4	2	5
SW CA DOC	2	0	0	2	2	1	0	1
SW CA State	5	0	0	5	5	2	1	3
SW CCC Group	33	0	2	26	28	10	10	14
SW EW/LG	547	4	1	23	28	40	6	41
SW UC/CSU Group	91	3	3	22	28	18	16	21

4.3.2 PG&E Electric NTG Findings

NTGRs for electric projects developed through PG&E programs were lower than the average NTGR for electric programs in general. Levels were lower than those reported in the PY2006-2008 evaluations for PG&E programs.

Table 4-3 below reports evaluation estimated NTGRs for the ten programs or program groups for which the number of surveys completed was sufficiently large.

Table 4-3: Weighted Net-to-Gross Ratios by Program/Program Group – Domain: PG&E Electric

Program Sampling Strata	Other 3P PGE	Calculated Incentives Commercial PGE21011	Calculated Incentives Industrial PGE21021	Calculated Incentives Agricultural PGE20131[1]	Pump Efficiency Services Program PGE20135[2]	Energy Efficiency Services for Oil Production PGE2222	Institutional Partnerships - State of California SW CA State[8]	Institutional Partnerships - Energy Watch, Local Government SW EW/LG[10]	Institutional Partnerships - UC/CSU SW UC/CSU[11]	All PGE Core
	NTGR									
1	0.37	0.77	0.22	-	-	0.50	-	-	-	0.44
2		0.50	0.34	0.67	-	0.45	-	-	0.56	0.45
3	0.45	0.60	0.59	0.59	0.37	0.23	-	0.29		0.59
4	0.59	0.39	0.29	0.51	0.34	0.28	-		0.58	0.42
5	0.44	0.37	0.40	0.36	0.41	0.23	0.57	0.42	0.58	0.38
Weighted NTGR	0.46	0.52	0.32	0.50	0.39	0.36	0.57	0.38	0.57	0.46
90 Percent CI	0.403 to 0.521	0.413 to 0.623	0.194 to 0.449	0.446 to 0.551	0.328 to 0.446	0.317 to 0.404	-	0.32 to 0.448	0.503 to 0.647	0.408 to 0.512
Relative Precision	0.13	0.20	0.40	0.10	0.15	0.12	-	0.17	0.12	0.11
n NTGR Completes	27	40	23	38	29	25	2	40	18	101
N Sampling Units	856	654	94	297	396	74	4	537	82	1045
ER	0.41	0.80	1.33	0.42	0.52	0.45	-	0.66	0.36	0.72

Notes:

1 No sampling units in stratum 1 for program group PGE21031
2 No sampling units in strata 1 and 2 for program group PGE21035
3 NTGR completes not available for each stratum for program PGE21042
4 NTGR completes not available for stratum 1 for program PGE2223
5 No stratum 2 for program PGE2225. Also, NTGR completes not available for stratum 5.
6 No stratum 1 for program group "RCx Group". Also, NTGR completes not available for stratum 2.
7 No strata 1, 2 and 5 for program group "SW CA DOC". Also, NTGR completes not available for stratum 4.
8 Program group "SW CA State" has 4 sampling units and two NTGR completes.
9 No sampling units in strata 1 or 2 for Program group "SW CCCC". Also, NTGR completes not available for stratum 3.
10 No sampling units in strata 1 or 2 for Program group "SW EW/LG".
11 No sampling units in stratum 1 for Program group "SW UC/CSU".

PG&E program domain-specific NTGR values range from a low of 0.32 (Core Calculated Incentives - Industrial) to a high of 0.57 (UC/CSU Institutional Partnership). Across all PG&E Core programs, the NTGR averaged 0.46, revealing substantial partial free ridership.

The very highest performing programs in this domain - those with among the highest NTGRs - still had NTGR values below 0.60, indicating moderate program influence on projects. These results are similar to those found in previous evaluations of nonresidential custom projects. These programs included the following:

- Institutional Partnerships program - UC/CSU (NTGR = 0.57).
  - In general, there may be a moderate level of program influence in this market segment because the state universities have very lean budgets according to project decision makers. On the other hand, these institutions also have longstanding and continuing mandates to continuously improve efficiency levels using whatever resources they can. Program incentives for the current cohort of projects in the sample were found to be somewhat significant to their taking action.
- Calculated Incentives Commercial program (NTGR = 0.52)
  - NTGRs for this program varied considerably across sample size strata. Stratum 1, consisting of the largest projects, had the highest NTGR, and included several large data center projects with among the highest NTGRs (0.77). However, there were other data center projects in Strata 2 and 4 where program influence was reported to be much lower, resulting in project NTGRs of 0.46, 0.49 and 0.33. This program also included a large number of chain drug store HVAC projects in the sample, which had low program influence since the chain had previously made the decision to install the project measures at a national level across all their stores.
- Calculated Incentives Agricultural program (NTGR = 0.50)
  - NTGRs were fairly consistent across all size Strata, except Stratum 5. The sample included several projects for large wineries which indicated relatively high program influence for installed measures. This was offset by smaller projects in Stratum 5 which were comprised of small farm efficiency improvements, several of which were reported as standard practice, resulting in low NTGRs.

The very lowest performing programs - those with among the lowest NTGRs – included several large Industrial customer programs. Cases in point are:

- Calculated Incentives Industrial program (NTGR = 0.32)
  - The verified NTGR for this program is much lower than the level of 0.54 for PY2006-2008 evaluations for PG&E programs' electric projects. The largest projects have among the lowest NTGRs, for example, the NTGR for stratum 1 projects is 0.22, while that for Stratum 2 projects is 0.34.

- A key cause of the low NTGRs is the inclusion in the sample of several large pump-off controller (POC) projects on new oil wells undertaken by a major oil producer where decisions were made and approvals received in PY2006-2008. In that evaluation, it was well-documented that POCs on new oil wells installed by major oil producing companies are standard practice and were assigned very low NTGRs. The main cause of this is the low incremental cost of a POC (around $2,000) versus the cost of drilling a new oil well (about $250,000). At that time, it was recommended that all of the IOUs discontinue incentives on new POC installations because of the low or zero reported program influence. *We continue to strongly encourage PG&E to discontinue incenting POCs on new oil wells, which clearly are standard practice.*
- Another root cause of the low NTGR for electric projects is low reported program influence for several sanitary district projects cutting across the 3 largest size Strata. These 3 projects have NTGRs of 0.30 (Stratum 1 project), 0.33 (Stratum 2 project), and 0.26 (Stratum 3 project). *Further investigation into NTGR findings for Sanitary district projects is recommended to assess whether decisions have already been made before the program becomes involved, and/or whether other drivers of free ridership/standard practice are present (such as that some of the installed measures are becoming standard practice). This could either be done via NTG interviews of an attempted census of sanitary district projects or through a separate Industry Standard Practice investigation.*

- PGE2222: Energy Efficiency Services for Oil Production program (NTGR = 0.36)
  - This low NTGR is also influenced by a number of medium and large legacy POC projects on new oil wells undertaken by medium size oil companies. Estimated NTGRs were also very low for these projects, based on decisions made in PY2006-2008, and confirmed as still in force in this PY2010-2012 evaluation. For the reasons stated above, the program incentive is not meaningful to the decision.
- Local Government Partnership, PG&E Energy Watch program (NTGR = 0.38)
  - Local city and county projects reported low program influence in general, and two were among the largest (Stratum 3s). NTGRs for these types of projects ranged from 0.17 to 0.31. *It would be useful to further probe into these local government projects to discern whether the target market is one where decisions have already been made before the program becomes involved, and/or whether other drivers of free ridership/standard practice are present This could either be done via NTG interviews of an attempted census of local city and county projects or through a separate Industry Standard Practice investigation.*

- PGE20135: Pump Efficiency Services program (NTGR = 0.39)
  - Among the lowest NTGRs for this program were those for municipal water district projects. NTGRs for many projects are in the 0.20 to 0.30 range. *Again, further examination is needed into this market segment to assess program effectiveness given the dynamics and timing of decision making by customers in this subgroup.*

4.3.3 PG&E Gas

In contrast to its electric projects within its programs, interim NTGRs for PG&E gas projects within its programs are significantly higher than those from the PY2006-2008 evaluation where the NTGR for gas projects averaged 0.31. As an example, the NTGR for gas projects across PG&E Core programs (0.62) is twice as high as that in the PY2006-2008 evaluation. As noted below, the sample if not yet representative of the largest projects so these interim results could still change significantly.

Table 4-4 below reports estimated NTGRs for the ten programs or program groups for which there was a sufficiently large number of completed surveys or the sample was a large percentage of a small population.

Note that not all of the programs have projects in all 5 strata and that the numbers of completed surveys for Strata 1 and 2 are few in number. This is because there are very few gas projects in Strata 1 and 2 in the program population in general. Most of the projects in the program population are smaller Strata 3, 4 and 5 projects. The implication is that Strata 1 and 2, which contain the largest projects, tend to need very few large projects to make up 1/5 of the total savings.

Table 4-4: Weighted Net-to-Gross Ratios by Program/Program Group – Domain: PG&E Gas

Program Sampling Strata	Calculated Incentives Commercial	Calculated Incentives Industrial	Calculated Incentives Ag	Heavy Industry Energy Efficiency Program	Refinery Energy Efficiency Program	Institutional Partnerships - Community Colleges	Local Government Partnership, PG&E Energy Watch	Institutional Partnerships - UC/CSU	All PGE Core
	PGE21011[2]	PGE21021[3]	PGE21031[4]	PGE2223[6]	PGE2225[7]	SW CCCC[11]	SW EW/LG[12]	SW UC/CSU[13]	
	NTGR								
1	-	-	-	-	0.28	-	-	-	-
2	-	0.65	-	-	-	-	-	-	0.65
3	-		-	-	-	-	-	-	
4	-	0.72	0.54	0.68	0.49	-	0.01	0.72	0.67
5	0.43	0.27	0.50		-	0.53		0.59	0.44
Weighted NTGR	0.43	0.64	0.52	0.68	0.30	0.53	0.01	0.66	0.62
90 Percent CI	0.297 to 0.572	0.596 to 0.685	0.481 to 0.559	0.622 to 0.744	0.300 to 0.300	0.479 to 0.572	0 to 0.027	0.588 to 0.732	0.578 to 0.653
Relative Precision	0.32	0.07	0.08	0.09	0.00	0.09	1.90	0.11	0.06
n NTGR Completes	22	18	19	8	3	10	6	16	59
N Sampling Units	158	37	41	22	3	23	20	61	236
ER	0.97	0.25	0.27	0.19	-	0.23	3.38	0.31	0.33

Notes:

1 No strata 1 and 2 for program group "Other 3P". Also, NTGR completes not available for stratum 4.
2 No strata 1-4 for Program 21011.
3 No strata 1 for Program 21021.
4 No strata 1-2 for Program 21031.
5 No strata 1-3 for program PGE21042. Also, NTGR completes not available for stratum 4.
6 No strata 1-3 for program PGE2223.
7 No strata 2, 3 and 5 for program PGE2225. There are NTGR completes for all 3 projects in this program (census).
8 No strata 1-4 for the "RCX Group". The program group has 8 sampling units and two NTGR completes.
9 Program group "SW CA DOC" has one sampling unit and no NTGR completes.
10 No strata 1-4 for program group "SW CA State". There is a NTGR complete for the one project in this program (census).
11 No sampling units in strata 1-4 for Program group "SW CCCC".
12 No sampling units in strata 1-3 for Program group "SW EW/LG". The project in stratum 4 is much larger than the other projects and drives the program-level NTGR result.
13 No sampling units in strata 1-3 for Program group "SW UC/CSU".

Program-specific gas NTGR values are predominantly in the range of 0.42 to 0.68, with several in the range of 0.60 to 0.70. The lowest values are NTGRs of 0.01 (Local Government Partnership, PG&E Energy Watch) and 0.30 (PGE225, Refinery Energy Efficiency Program); however, note the sample sizes for both of these are fairly small.

Among the programs with relatively higher interim NTGRs are:

- PGE2223 - Heavy Industry Energy Efficiency Program (NTGR = 0.68)
  - This third party program had the highest interim NTGR of the group; however, the projects evaluated were among the smallest, all in Strata 4 and 5. The largest project in this program sample accounted for 73% of the savings in the projects evaluated and was primarily driven by the customer's need to reduce energy use at its plant in order to remain financially viable. The program rebate was reported to be key to their decision to do the project.
- Institutional Partnerships - UC/CSU (NTGR = 0.66)
  - Another program with a higher interim NTGR relative to other programs was the UC/CSU Partnership program. This result is consistent with NTGR findings in the PY2006-2008 evaluation. As stated previously, the fact that state universities' capital budgets are very constrained at present may be increasing the importance of utility incentives in decision making, resulting in relatively low free ridership.
- PGE21021: Calculated Incentives Industrial (NTGR = 0.64)
  - The NTGR for the Calculated Incentives Industrial program were much improved over the PY2006-2008 evaluation result. The results for this program were dominated by several large energy efficiency projects for refineries (in Strata 2, 3 and 4), which reported medium to high program influence in all cases. In addition all of these projects have a primary focus of energy efficiency improvement, and many consisted of making a process change in order to significantly reduce energy use. In contrast, the PY2006 – 2008 results were heavily influenced by large refinery and other industrial projects that were largely being done for reasons other than saving energy, thus resulting in high free ridership. Note that the Stratum 5 NTGR of 0.27 is much lower than those for Stratum 2/3 (0.65) and Stratum 4 (0.72). However, all Stratum 5 projects are small in terms of claimed savings, thus the low NTGR does not have much of an effect on the average NTGR for the program overall.

Those programs or program groups with very high free ridership, based on the NTG surveys and analyses completed to date, were the Local Government Partnership, PG&E Energy Watch program group and the PGE2225 Refinery Energy Efficiency Program. Each of these is discussed below.

- Local Government Partnership, PG&E Energy Watch program group (NTGR = 0.01)
  - Although we have estimated NTGRs for a total of 6 projects to date in this group, the savings and NTGR weight are dominated by one large project which had an NTGR of 0.00. The NTG interview revealed that this boiler replacement project was motivated by the need to replace failing boilers in a manner that complied with environmental regulations. The customer repeatedly stated that they would have installed the high efficiency boilers anyway, and that, while it was nice to have the rebate, the number one driver was environmental emissions requirements imposed by local regulatory air quality rules; payback was never a serious consideration. This Stratum 4 project accounted for 95% of savings for the NTG sample completed to date for the group, while the remaining 5 Stratum 5 projects were much smaller and had a very small effect on the weighted NTGR. However, even among these Stratum 5 projects, NTGRs were very low in general (with 3 of the 5 having NTGRs between 0.00 and 0.20).
- PGE2225 Refinery Energy Efficiency Program (NTGR = 0.30)
  - Similarly, this program result is reflective of a small sample size (N=3)[28] and dominance by one large project (NTGR of 0.28) which accounted for 87% of the total group savings. This oil refinery project involved installation of a Flue Gas Scrubber to remove sulphur emissions and recover energy via addition of a waste heat boiler. During the NTG interview, the customer indicated that if the program and incentive had not been available, they probably would have installed it anyway. They scored the rebate importance only a 3.5 on a 0-10 importance scale. The rebate, while substantial ($3.8 million), accounted for about 33% of the total project cost.

4.3.4 SCE Electric

Interim NTG ratios for SCE's programs (all resulting in electric savings) are somewhat lower than those estimated for SCE's Industrial Programs in PY2006 – 2008, which had an NTGR of 0.63.

Table 4-5 below provides a summary, for each SCE sampling domain or program, of the number of projects in the population to-date, the associated number of sampled projects, and the number of completed NTG surveys.

[28] Note that this program only had 10 custom participants in the total population.

Table 4-5: SCE Custom Population and NTGR Sample by Program Domain

Program Domain	Population N	M&V Sample n Sample	Supplemental NTG n Sample	Total NTG n Sample	NTG n Completes
All	1,153	50	170	220	123
SCE-SW-002B	372	9	19	28	20
SCE-SW-003B	199	15	13	28	13
SCE-SW-004B	281	6	22	28	28
SCE-SW-005A	128	11	17	28	0
Other 3P SCE Group	45	3	25	28	22
SCE LG	76	2	26	28	18
SW CA DOC	1	0	1	1	1
SW CA State	4	0	4	4	2
SW CCC	25	3	22	25	4
SW UC/CSU	22	1	21	22	15

In the current evaluation to date, individual program and program group NTGRs are clustered around 0.50 as shown in Table 4-6 below. Only one program had NTGR results that deviated from this (Institutional Partnerships – Department of Corrections with an NTGR of 0.77); however, this result is based on only one customer project.[29] Aside from this program, NTGR values range from 0.49 (Institutional Partnerships – Local Government) to 0.55 (Institutional Partnerships – UC/CSU).

[29] Note that this program only had 1 custom participant in the total population.

Table 4-6: Weighted Net-to-Gross Ratios by Program/Program Group. Domain: SCE - Electric

Program Sampling Strata	Institutional Partnerships - Local Government SCE LG[2]	Calculated Incentives Industrial SCE-SW-003B	Calculated Incentives Ag SCE-SW-004B[4]	Institutional Partnerships - Dept of Corrections SW CA DOC[6]	Institutional Partnerships - UC/CSU SW UC/CSU	All SCE Core
1	-	0.58	-	-	-	0.56
2	0.50		-	-	0.61	
3	0.75	0.46	0.41	0.77		0.47
4	0.44			-	0.46	0.42
5	0.37		0.54	-	0.53	0.47
Weighted NTGR	0.49	0.52	0.48	0.77	0.55	0.50
90 Percent CI	0.443 to 0.535	0.447 to 0.602	0.433 to 0.521	0.77 to 0.77	0.505 to 0.599	0.456 to 0.535
Relative Precision	0.09	0.15	0.09	0.00	0.09	0.08
n NTGR Completes	18	13	28	1	15	61
N Sampling Units	76	199	281	1	22	852
ER	0.28	0.33	0.31	0.00	0.36	0.39

NOTES:

1 NTGR completes not available for each stratum for program group "Other 3P SCE"
2 No sampling units in stratum 1 for program group SCE LG
3 NTGR completes not available for each stratum for program group "SCE-SW-002B"
4 No sampling units in strata 1 or 2 for program group SCE-SW-004B
5 No NTGR completes for SCE-SW-005A
6 Program SW CA DOC has only one project, for which there is a NTGR complete.
7 Program SW CA STATE has four projects, for which there are two NTGR completes.
8 Program SW CA CCCC has 25 projects, but only four NTGR completes.

Among SCE's Core programs are its Calculated Incentives Industrial program, with an NTGR of 0.52, and its Calculated Incentives Agricultural program, with an NTGR of 0.48 (Agricultural). The average NTGR for all SCE Core programs was exactly 0.50.

Results by SCE program and program group are somewhat more revealing as discussed below.

- Institutional Partnerships – Local Government (NTGR = 0.49)
  - There is a diverse mix of projects in this program group. Several of the projects are for municipal water/wastewater treatment plants, and these generally have low to medium NTGRs, generally in the range of 0.20 to 0.55. Many such projects are done only partly for improvement of energy efficiency; more important reasons are to achieve greater reliability of operation, to improve the degree of control over the equipment, or to undertake a required upgrade. In the process of achieving these ends, the customer has also selected more efficient equipment, but as a decision influencer, energy efficiency is lower than these other factors.

    Two of the larger projects in this program group involved retrocommissioning / RCx of existing equipment by municipalities. These projects both had high NTGRs of 0.83. During the NTG interview, the decision makers revealed that retrocommissioning is not routinely done by their municipality due to lack of capital. The potential for high program influence given these circumstances is much greater. These same findings and conclusions were also drawn in the PY2006-2008 evaluation of RCx programs. Another category of projects that had low NTGRs were Agricultural pump system overhauls for municipalities. There were several such projects in the Stratum 5 sample, and these were generally being done for reasons other than energy efficiency improvement, chief among them to improve reliability.
- SCE-SW-003B: Calculated Incentives Industrial (NTGR = 0.52)
  - The evaluated projects in this program represented a wide range of business types and applications; therefore, it is not possible to draw conclusions about any particular type of measure or application.
  - Nearly all projects had NTGRs of 0.50 and above.
  - The level of program influence for the very largest projects in Strata 1 and 2 was generally high, most with NTGRs exceeding 0.60 and several above 0.70. Only one project had a low NTGR (0.28) in this group of larger size projects. These projects had many other non-program factors influencing their decision to do the project; however, program influence was still significant.
  - For smaller projects in Strata 3, 4 and 5 (NTGR = 0.46), the level of program influence was somewhat less. Again, these consisted of a diverse mix of projects with unique customer specific circumstances governing the level of free ridership.

- SCE-SW-004B: Calculated Incentives Agricultural (NTGR = 0.48)
  - All projects evaluated were generally smaller in size, and associated with Strata 3, 4 or 5.
  - Most of the projects evaluated consisted of agricultural pump system overhauls. These had a wide range of NTGRs, ranging from 0.20 to 0.77, and averaging close to the program value of 0.48.
  - Other installed technologies included ventilation fans in barns, milk pump VFDs, and compressor VFDs.
  - Again, there was no systematic pattern to NTGRs by measure type.
- Institutional Partnerships – Department of Corrections (NTGR = 0.77)
  - This consisted of one very large customer project which is also the only Custom project in the program population. In this sense, it can be thought of as a case study.
  - This project had a high NTGR. In the interview, it was stated: "(This) is a state facility so funding is not there. Energy efficiency projects are prioritized only if rebates can bring the simple payback to 5 years or less. Incentives that help achieve this are vital to approval."
  - The conclusion is that energy efficiency program incentives can be helpful to these types of state facilities that generally do not have access to capital to fund efficiency improvements, unless project paybacks can be met.
- Institutional Partnerships –UC/CSU (NTGR = 0.55)
  - The target market for this program group consists of large state funded university systems. Funding is scarce for capital improvement projects, and utility program incentives can be key to making the projects viable.
  - The NTGR of 0.55 for this program is based on a mix of small and medium size projects (Strata 2, 3, 4 and 5) done by several state universities. There was some variation in results by project size, with the larger Stratum 2 and 3 projects having a somewhat higher NTGR of 0.61, while Stratum 4s (NTGR = 0.46) and Stratum 5s (NTGR = 0.53) are somewhat less.
  - One large university had 7 of the 14 projects in this program group, comprising a number of different measures. NTGRs for these projects ranged from 0.30 to 0.73, and most were 0.60 and above. During the NTG interview, the decision maker revealed that the projects originated from a comprehensive energy plan developed in 2008, with one of its key goals to reduce their carbon footprint as required by the university system. Other key factors driving projects include the desire to save energy, and to lower maintenance requirements. He also stated, "The rebate program is one of the big reasons we're doing it. We need the additional funding source to help pay. Without the incentive some projects wouldn't have paid back, we

wouldn't have done them." All of this suggests a mix of program and non-program factors were present in the decisions to implement these projects.

- Another large university had the remaining 7 of the 14 projects in this program group, consisting of a mix of new construction projects, and chiller and refrigeration upgrades. The NTGR for these projects was 0.47, revealing there were many other non-program factors influencing their decision to do the project. In the NTG interview, the decision maker indicated that they try to integrate energy efficiency upgrades into capital improvement projects if specific payback requirements can be met. He also stated, "The utility rebate program has always been a major impact to our energy program. The financial incentives help bring the project to the front of the line."

4.3.5 SDG&E Electric and Gas

Table 4-7 below provides a summary, for each SDG&E sampling domain or program, of the number of projects in the population to-date, the associated number of sampled projects, and the number of completed NTG surveys.

Table 4-7: SDG&E Custom Population and NTGR Sample by Program Domain

Program Domain	Population	M&V Sample		Supplemental NTG	Total NTG	NTG Completes		
	N	Electric n	Gas n	n Sample	n Sample	Electric n	Gas n	Unique n
All	532	30	4	50	84	44	12	47
SDGE Core Calc	120	7	0	21	28	20	4	22
SDGE3117	331	17	2	9	28	23	8	24
SDGE3118	81	6	2	20	28	1	0	1

Only two programs or program groups had sufficient sample to be able to report on, SDGE Core and SDGE3117 (Non Residential BID). Table 4-8 below reports the NTGR results for these two programs/program groups.

Table 4-8: Weighted Net-to-Gross Ratios by Program/Program Group – Domain: SDGE – Electric

Program Group Sampling Strata	SDGE Core[1]	Non-Residential (BID) SDGE3117
	NTGR	
1	-	0.50
2	0.52	0.41
3		0.25
4	0.56	0.45
5	0.30	0.52
Weighted NTGR	0.49	0.43
90 Percent CI	0.44 to 0.533	0.364 to 0.502
Relative Precision	0.10	0.16
n NTGR Completes	20	23
N Sampling Units	98	319
ER	0.29	0.48

NOTES:

1 No sampling units in stratum 1 for program group SDGE Core
2 Program SDGE3118 has 79 projects but only one complete

- SDGE Core
  - The weighted NTGR across all SDGE Core projects was 0.49.
  - Strata 2, 3 and 4, representing small and medium sized projects, had similar NTGRs just above 0.50. Stratum 5, comprised of very small projects, had a much lower NTGR of 0.30, and most projects in this Stratum had low NTGRs in the range of 0.19 to 0.37.
- SDGE3117 (Non Residential BID)
  - The weighted NTGR across all SDGE3117 (Non Residential BID) program projects was 0.43.
  - Results for Strata 1 and 2 (representing the largest projects) and 4 and 5 (representing the smallest projects) were similar, with NTGRs ranging from 0.41 to 0.52. Stratum 3, consisting of medium sized projects had a much lower NTGR of 0.25.
  - Stratum 1 and 2 included several large projects undertaken by universities and related institutions. All of these projects were done for multiple reasons, including the desire to save on energy costs, and program influence was moderate. One

decision maker representing the largest project stated that energy efficiency is not a priority among university projects, and therefore, energy efficiency projects need to be self-funded in order to be approved. Program rebates help in this respect. Another expressed a similar philosophy for his organization, that facilities projects are on a need basis and payback requirements must be met. If a project can pay for itself within 3.5 years, it can be done. Utility rebates definitely help to fulfill payback period requirements.

- Stratum 3 projects included multiple projects, 3 of the 5 evaluated, involving installation of CO sensors in parking ramps. These were reported as routine installations by the decision maker and received NTGRs of 0.00, thereby pulling down the NTGR for this size stratum.

5

Lower Rigor Assessment

5.1 Introduction

This chapter discusses results of the 'Lower Rigor Assessments'. These assessments represent an effort to provide cost effective program specific impact-oriented findings and feedback. The 200 sites selected for M&V gross impact study in the BD Period have been supplemented with 100 sites that received a less rigorous review – a lower rigor assessment. The lower rigor assessment entailed the following items: a review of project application paperwork received from the IOU and an assessment of the documentation provided; a check for adherence to rules and guidelines; and an assessment of savings estimation techniques. See Appendix C for more information on the details of the Lower Rigor Assessment Form and an explanation of issues assessed. The goal of this effort is to provide a broad qualitative assessment of the successes and shortcomings of the program implementation processes. Lower rigor points expand the reach of the evaluation to programs that would not receive much attention based on M&V sample allocation alone due to budget constraints. Lower rigor assessment results do not contribute to the determination of custom impact accomplishments; they provide more general feedback regarding conformance with sound impact-related and project application practices.

Assessment results are also the subject of evaluation work in the Program Assessments Core Calculated Report.[30] The Core Calculated Report is one chapter of a joint IOU-ED study that characterizes and assesses the strengths and weaknesses of several groups of non-residential programs. Report methodology does not meet rigor standards of evaluation in California, but does address a large body of programs and a comprehensive set of program design and implementation topics. The study relies on interviews with program managers and implementers, and relies heavily on secondary sources. The LRA data was leveraged for the Core Calculated Report to provide additional insight and characterization of program performance. It presents the overall LRA results, as well as results for the IOU Core Calculated programs and several other groups including third party programs and statewide partnerships. The LRA results presented here provide a more thorough review of results and at a more granular level. Relative to the Core Calculated Report, the results shown below include several additional programs and program groups, and provide all relevant program specific findings.

[30] The Program Assessment Core Calculated report will be publicly available on the CPUC public documents website in December 2012 (http://www.energydataweb.com/cpuc/home.aspx).

5.1.1 Notes on Extrapolating Lower Rigor Assessment Results to Impact Results

The lower rigor assessments are useful in determining the adequacy of project documentation and the method of savings calculations. The lower rigor assessment also can help assess if an accurate baseline determination was made. When a sufficient number of assessments are made across a portfolio, comparisons between programs and program groups can be made on a qualitative basis.

The assessments are an un-weighted sampling of project application performance across a number of issues (See Table 5-7 for the issues analyzed and Appendix C for more detail on the LRA process.)

Lower rigor assessment outcomes are qualitative in nature and are not inherently indicative of likely impact evaluation findings and quantitative results. There is no quantification of any possible increase or decrease in the project specific ex-ante savings estimates from this lower rigor assessment or the performance on any specific issue. To illustrate this, consider that custom projects can vary widely in project size. Then consider a program with many projects with no apparent shortcomings but one or two very large projects with baseline or eligibility issues. This program may receive an "above average" lower rigor assessment result across projects, but a poor gross realization rate (GRR) across those same projects. The distribution of the type of issues and the degree of the shortcomings also matter. A program falling short in its use of post-installation M&V or in the accuracy of their tracking may or may not see the repercussions reflected in their GRR.

With custom projects, critical particulars are often apparent with a deeper look and simply imperceptible with a lower rigor approach, even a very thorough one. Combine this attribute with a large variance in project size, and there is potential for project and program GRRs to diverge from the lower rigor results. Lower rigor assessments are more likely to miss issues that can only be fully addressed with an M&V approach. The interim M&V results support this notion in that the most significant findings were found to be due to factors that can only be uncovered through on-site data collection activities.

5.2 Sample Design and Disposition

In total, 300 lower rigor assessments were completed for the BD period. Of these, 200 were assessed in conjunction with the "Before Decision" M&V points and 100 were supplemental "Before Decision" lower rigor (LR) points. The M&V points contribute to the LRA findings and will ultimately also be part of the gross impact realization rate. The 100 low rigor sample points contribute only to LRA reporting and are solely qualitative assessments.

The supplemental LRA points are strategically allocated to support the assessment of impact-related attributes across a range of custom programs. The selection of custom programs targeted by the supplemental points was a collaborative process between the CPUC Custom Impact (WO33) evaluation team and the IOUs. PG&E and SCE constructed a list of programs they recommended for inclusion in the LRA sampling; these were used to help construct the "programs of interest".[31] At the time of the sample selection, SDG&E and SCG were conducting their own nonresidential program process evaluation, which addressed their program specific priorities. They did not have additional programs of interest to recommend.

PG&E and SCE specifically identified many programs that these IOUs were interested in assessing, with a priority of high (H) or Medium (M). Table 5-1 below presents the IOU recommendations for programs to target with supplemental points, with the associated level of priority.

Table 5-1: IOU Recommendations and Priorities for LRA Sample

Program ID	Program Name	IOU Priority
PGE21035	Pump Efficiency Services Program	M
SCE-SW-002A	Non-Residential Audits	H
SCE-SW-003A	Industrial Energy Audit Program	H
SCE-SW-004A	Agriculture Energy Audit Program	H
SCE-SW-004E	Pump Test Services Program	H
PGE21011	Calculated Incentives	M
SCE-SW-002B	Calculated Incentives Program	M
SCE-SW-003B	Calculated Energy Efficiency Program	M
SCE-SW-004B	Calculated Energy Efficiency Program	M
PGE21012	Deemed Incentives	H
PGE21022	Deemed Incentives	H
PGE21032	Deemed Incentives	H
SCE-SW-002C	Deemed Incentives Program	M
SCE-SW-003C	Industrial Deemed Energy Efficiency Program	M
SCE-SW-004C	Deemed Energy Efficiency Program	M
SCE-SW-002D	Commercial Direct Install Program	H
SCE-SW-002E	Continuous Energy Improvement, core sub-program	H
SCE-SW-003D	Continuous Energy Improvement, core sub-program	H
PGE2130	Association of Monterey Bay Area Governments (AMBAG) Energy Watch	H

[31] See the Custom Impact WO033 BD Period Sampling Addendum 2010-2012 Impact Evaluation of November 17, 2011 (available at http://www.energydataweb.com/cpuc/home.aspx) for a full listing of the programs of interest and the lower rigor sampling plan.

Table 5-1 (Cont'd): IOU Recommendations and Priorities for LRA Sample

Program ID	Program Name	IOU Priority
PGE2131	City of San Joaquin Energy Watch	H
PGE2132	East Bay Energy Watch	H
PGE2133	Fresno County Energy Watch	H
PGE2134	Kern County Energy Watch	H
PGE2135	Madera County Energy Watch	H
PGE2136	Marin County Energy Watch	H
PGE2137	Mendocino County Energy Watch	H
PGE2138	Napa County Energy Watch	H
PGE2140	San Joaquin County Energy Watch	H
PGE2141	San Luis Obispo County Energy Watch	H
PGE2142	San Mateo County Energy Watch	H
PGE2143	Santa Barbara County Energy Watch	H
PGE2144	Sierra Nevada Energy Watch	H
PGE2145	Sonoma County Energy Watch	H
PGE2146	Silicon Valley Energy Watch (San Jose)	H
PGE2147	San Francisco Energy Watch	H
PGE21261	CA Community Colleges	H
PGE21262	University of California/California State University	H
PGE21263	State of California	H
PGE21264	CA Dept of Corrections and Rehabilitation	H
SCE-TP-010	Data Center Energy Efficiency	H
SCE-TP-012	Lodging EE Program (LEEP)	M
SCE-TP-023	Cool Schools	M
SCE-TP-024	Public Pre-Schools, Elementary Schools and High Schools	M
SCE-TP-026	Commercial Utility Building Efficiency (CUBE)	M
SCE-TP-031	Management Affiliates Program (MAP)	M
SCE-TP-033	Automatic Energy Review for Schools	M
SCE-TP-036	Energy Efficiency for Entertainment Centers	M
SCE-TP-037	Private Schools and Colleges Program	M
PGE2221	California Wastewater Process Optimization	M
PGE2222	Energy Efficiency Services for Oil Production	M
PGE2223	Heavy Industry Energy Efficiency Program	M
PGE2225	Refinery Energy Efficiency Program	M
PGE2228	Industrial Recommissioning Program	M
SCE-TP-013	Food & Kindred Products	M
SCE-TP-014	Primary and Fabricated Metals	M
SCE-TP-015	Industrial Gasses	M
SCE-TP-016	Nonmetallic Minerals and Products	M
SCE-TP-017	Comprehensive Chemical Products	M

Table 5-1 (Cont'd): IOU Recommendations and Priorities for LRA Sample

Program ID	Program Name	IOU Priority
SCE-TP-018	Chemical Products Efficiency Program (CPEP)	M
SCE-TP-019	Comprehensive Petroleum Refining	M
SCE-TP-020	Oil Production	M
SCE-TP-021	Refinery Energy Efficiency Program (REEP)	M
SCE-SW-007A	Upstream HVAC Equipment Incentive	H
SCE-SW-007C	Commercial Quality Installation	H
PGE2187	Monitoring-Based Persistence Commissioning	M
PGE2203	Monitoring-Based Commissioning	M
SCE-TP-027	Monitoring-Based Commissioning (MBx)	H
SCE-TP-028	Monitoring-Based Persistence Commissioning Program (MBPCx)	H
SCE-L-003	Integrated Demand Side Management Pilot for Food Processing	H
SCE-TP-030	Sustainable Portfolios	M
SCE-TP-034	Sustainable Communities	H

Table 5-2 below presents the outcome of the collaborative LRA sample design process. The Table presents those programs selected as "Programs of Interest" by the IOUs and the evaluation team. To maximize the comprehensiveness of the LRA supplemental points across these many Programs of Interest, some programs were mapped to a sampling domain that would include groups of programs, either statewide or within an IOU portfolio. The sampling domain is listed in the third column of the table. For example, the California Community College Partnership was mapped to a statewide 'CCC Partnership' sampling domain. The LRA points were allocated with a minimum threshold of five to eight projects for program-level feedback.

Note that the programs with the most activity naturally had a greater number of reviewed projects while those with less activity had fewer. In some cases, programs grouped together in a single sampling domain had enough reviews to report at the program-specific level, such as CCC Partnership and the UC/CSU Partnership. In other cases, there were not enough points within a domain to yield a domain level result, such as the CDCR partnership. For convenience, the number of completed assessments for each program is shown in the last column on the right.

Table 5-2: IOU "Programs of Interest" Mapping to Sampling Domain and Assessment Completes (M&V and LR Points)

Program ID	Program Name	Domain	Assessments
PGE21261	California Community Colleges	CCC Partnership	9
SCE-L-005A	California Community Colleges		10
SCE-L-005B	Department of Corrections and Rehabilitation	CDCR Partnership	1
PGE21264	Department of Corrections and Rehabilitation		2
SCE-L-005F	State of California	DGS Partnership	4
PGE21263	State of California		5
SCE-L-005G	UC/CSU Energy Efficiency Partnership	UC/CSU Partnership	10
PGE21262	University of California/California State University		11
PGE2132	East Bay Energy Watch	Energy Watch	1
PGE2145	Sonoma County Energy Watch		1
PGE2133	Fresno County Energy Watch		2
PGE2147	San Francisco Energy Watch		4
SCE-L-004H	Community Energy Leader Partnership	SCE LG	1
SCE-L-004M	Orange County Cities Energy Leader Partnership		1
SCE-L-004S	Ventura County Energy Leader Partnership		1
SCE-L-004C	City of Redlands Energy Leader Partnership		2
SCE-L-004P	San Joaquin Valley Energy Leader Partnership		2
SCE-L-005C	County of Los Angeles Energy Efficiency Partnership		2
PGE2228	Industrial Recommissioning Program	RCx Group	3
PGE2187	Monitoring-Based Persistence Commissioning		5
PGE2222	Energy Efficiency Services for Oil Production	Program Specific	10
PGE2225	Refinery Energy Efficiency Program		10
PGE2223	Heavy Industry Energy Efficiency Program		9
SCE-SW-005A	Savings By Design		12
Total			118

Of course, many programs were sampled because they are inherently important or interesting because of their size. The programs shown below were not flagged by the IOUs as high priority 'Programs of Interest", but were sampled due to their relative size and importance in the overall portfolio performance. The SDG&E and SCG Core Calculated programs were grouped into an IOU-specific domain for the purposes of sampling; PG&E and SCE Core Calculated programs were sampled at the individual sector level program level. Table 5-3 below shows the significant programs in the low rigor and M&V sample, included for their inherent importance. Programs are shown with the sampling domain and the number of completed assessments.

Table 5-3: Programs Sampled for Portfolio Significance Mapped to Domain and Completed Assessments

Program ID	Program Name	Domain	Assessments Completed
PGE21021	Industrial Calculated Incentives	Program Specific	22
PGE21011	Commercial Calculated Incentives		14
PGE21031	Agricultural Calculated Incentives		9
PGE21042	Savings By Design		9
PGE2223	Heavy Industry Energy Efficiency Program		9
SCE-SW-003B	Industrial Calculated Energy Efficiency Program		15
SCE-SW-004B	Agriculture Calculated Energy Efficiency Program		9
SCE-SW-002B	Calculated Incentives Program		8
SCG3611	SW-IndA – Calculated	SCG Core Calculated	17
SCG3607	SW-ComA – Calculated		7
SCG3602	SW-AgA – Calculated		1
SCG3625	SW-NCNR - NRNC Savings By Design	Program Specific	2
SDGE3117	Local03 - Local Non-Residential (BID)	Program Specific	19
SDGE3118	SW-NCNR - NRNC Savings By Design		10
SDGE3105	SW-ComA – Calculated	SDG&E Core Calculated	8
SDGE3109	SW-IndA – Calculated		2
Total			**161**

Finally, there were a number of third party programs assigned a 'medium' or 'low' level of interest by the IOUs. These were grouped into "Other Third Party" domains by IOU for the purposes of sampling. None of these programs obtained enough sample point results to be reported individually, so the reporting of results shown later in this chapter is at the domain level. Table 5-4 below lists these programs and their sampling domain, along with the number of completed assessments.

Table 5-4: PG&E and SCE "Other Third Party" Program Domains

Program ID	Program Name	Domain	Assessments
SCE-TP-016	Nonmetallic Minerals and Products	Other SCE Third Party	3
SCE-TP-013	Food & Kindred Products		2
SCE-TP-014	Primary and Fabricated Metals		2
SCE-TP-020	Oil Production		1
SCE-TP-025	Retail Energy Action Program		1
SCE-TP-006	Healthcare EE Program		1
PGE2182	Boiler Energy Efficiency Program	Other PG&E Third Party	3
PGE2221	California Wastewater Process Optimization		2
PGE2197	Small Business Commercial Comprehensive		2
PGE2186	Enhanced Automation Initiative		1
PGE2209	Ozone Laundry Energy Efficiency		1
PGE2231	Industrial Refrigeration Performance Plus		1
PGE2196	Right Lights		1
Total			**21**

Table 5-5 below shows the completed lower rigor reviews for PG&E for each sampling domain. These are grouped by domain type which is shown in the first column. The number of points in the "M&V" and "LRA only" sample are shown in the last two columns.

Table 5-5: PG&E LRA Disposition by Sampling Domain

Domain Type	Sampling Domain	Total	LR Only	M&V
IOU Group	Other 3P PGE Group	11	2	9
	RCx Group	8	8	0
	Energy Watch	8	4	4
Statewide	CDCR Partnership	2	2	0
	DGS Partnership	5	5	0
	CCC Partnership	9	7	2
	UC/CSU Partnership	11	5	6
Program Specific	PGE21021 Industrial Calculated Incentives	22	0	22
	PGE21011 Commercial Calculated Incentives	14	0	14
	PGE2222 Energy Efficiency Services for Oil Production	10	0	10
	PGE2225 Refinery Energy Efficiency Program	10	6	4
	PGE21031 Agricultural Calculated Incentives	9	1	8
	PGE21035 Agricultural Pump Efficiency Services Program	9	7	2
	PGE21042 Savings By Design	9	4	5
	PGE2223 Heavy Industry Energy Efficiency Program	9	5	4
Total PG&E		**146**	**56**	**90**

Table 5-6 below shows the completed lower rigor reviews for SCE for each sampling domain, grouped by Domain Type. The number of points in the M&V and LRA only sample are shown in the last two columns.

Table 5-6: SCE LRA Disposition by Sampling Domain

Domain Type	Sampling Domain	Total	LR Only	M&V
IOU Group	Other 3P SCE Group	10	7	3
	SCE LG	9	7	2
Statewide	CDCR Partnership	1	1	0
	DGS Partnership	4	4	0
	CCC Partnership	10	7	3
	UC/CSU Partnership	10	9	1
Program Specific	SCE-SW-003B Industrial Calculated Energy Efficiency Program	15	0	15
	SCE-SW-005A Savings By Design	12	0	12
	SCE-SW-004B Agriculture Calculated Energy Efficiency Program	9	3	6
	SCE-SW-002B Calculated Incentives Program	8	0	8
Total SCE		**88**	**38**	**50**

Table 5-7 below shows the programs and completed assessments for the SDG&E and SCG portfolios.

Table 5-7: SDG&E and SCG LRA Disposition by Sampling Domain

IOU	Domain Type	Domain	Total	LR	M&V
SDG&E	Program Specific	Nonresidential BID	19	0	19
		Nonresidential New Construction	10	2	8
	IOU Group	Core Calculated	10	3	7
		Total SDG&E	**39**	**5**	**34**
SCG	IOU Group	Core Calculated	25	0	25
	Program Specific	Nonresidential New Construction	2	1	1
		Total SCG	**27**	**1**	**26**

5.3 Lower Rigor Assessment Results

This section summarizes lower rigor assessment results by program, sampling domain and other program groupings. A full reporting of Core Calculated Programs' lower rigor results can be found in the Program Assessments Core Calculated Report. In this section, results are presented by the following categories or groupings:

- Individual program,
- IOU-specific sampling domains,
- statewide sampling domains, and
- IOU.

5.3.1 Assessment Methodology Recap

The Lower Rigor Assessments were completed using a template form that guided the evaluating engineer through critical application quality issues. These issues were selected because they were considered to be critical to the final realization rate, as well as to reflect problems that were flagged through the evaluation process in the previous 2006-2008 program cycle. Each critical issue was categorized into one of five areas:

1. Unable to assess, meaning there wasn't enough information available in the project files to make an assessment;
2. Not applicable, meaning this issue does not apply to the particular project being reviewed;
3. Good, meaning the treatment of this issue clearly meets protocol and quality guidelines;
4. Neutral, meaning the treatment of this issue isn't clearly flawed and isn't clearly well within quality standards; and
5. Poor, meaning the treatment of this issue does not meet protocol and/or quality guidelines for project applications.

Details regarding the assessment template and scoring criteria are presented in Appendix C and Appendix D of this report.

5.3.2 LRA Results and Performance Analysis

The aggregated and average LRA results have been analyzed and presented in previous reporting.[30] In this section, the variants from average performance are used to highlight areas of success or areas of concern by program and program grouping.

Performance analysis in this report keys primarily off of the percent of assessments that result in a "poor" assessment score in any given key issue. While the intent is not to focus on the negative per se, scores of "poor" are more definitive than either "good" or "neutral". More specifically, "good" is not critically distinguishable from "neutral" in terms of being indicative of adherence to protocol. At times, it is the specific informational attributes of a project and a particular issue that lead to the selection of "neutral" rather than "good". Together, "good" and "neutral" can be considered the percent of projects receiving a "pass"; "poor" indicates there was a shortcoming, issue or problem.

The distribution of "poor" outcomes across all programs and groupings was analyzed to determine the boundary that distinguishes a 'typical' program from one that stands out, either as 'above average' or as one that is 'below average'. More specifically, the mean and 90 percent confidence interval for the 'percent poor' determine these cutoffs. Programs showing a 'percent poor' in a given issue that falls below the lower bound of the 90% confidence interval are flagged as 'above average' in that issue area. Programs with a score greater than the upper bound of the 90 percent confidence interval are those with performance 'below average' in the issue area.

5.3.3 Overall Portfolio Results

Aggregate results across all completed lower rigor assessments are shown in Table 5-8 below. Portfolio level assessment issues and the portfolio level results are shown below. For each issue, the number of contributing assessments and the percent scoring "Good", "Neutral" and "Poor" are shown in the table. Sample sizes vary by issue due to applicability of the issue to the application or missing information. The Program Assessments Core Calculated Report30 presents a review and analysis of these results. Table 5-8 is shown for its capacity to provide context for program and program group performance.

Table 5-8: Lower Rigor Results, All Assessments

Key Issue Assessed	Assessment Results (Ns)	Assessment Results (%)		
		Good	Neutral	Poor
Project Documentation & Specification				
IOU Application Documentation Complete and Accurate	298	44%	32%	24%
IOU Tracking Data Complete and Accurate	296	37%	41%	22%
Project utilized pre-installation M&V	235	40%	24%	37%
Appropriate Baseline	273	81%	0%	19%
Early Replacement Claim: Valid RUL / EUL Approach Used	156	65%	0%	35%
Appropriate Calculation Method				
Appropriate Impact Calculation Method	277	49%	33%	18%
All Relevant Inputs Considered	270	82%	0%	18%
Adequate Values for All Inputs	265	36%	45%	19%
Appropriate HVAC Interactive Effects Calculation Method	12	25%	0%	75%
Appropriate non-HVAC Interactive Effects Calculation Method	53	75%	15%	9%
Project utilized post-installation M&V	296	29%	33%	38%
Compliance with Program Rules				
Measures are IOU Program Eligible	286	99%	0%	1%
Measures Exceed Code or Industry Standard Practice	251	91%	0%	9%
Multiple IOU Fuel Impacts Properly Accounted for (includes Fuel Switching and Cogeneration)	17	47%	0%	53%
If Applicable, Fuel Switching Supported with Three Prong Test	8	38%	0%	63%
Non-IOU Fuel and Ancillary Impacts of Project Properly Accounted for (Cogen/Waste Heat Recovery/ Refinery Gas, etc.)	79	24%	0%	76%
Customer Installation Meets All Program Rules	281	90%	0%	10%

5.3.4 Program Specific Assessment Results

This section presents LR assessment results for individual programs. Results are presented in tabular form for programs with eight or more completed assessments. Programs with between four and seven completed assessments are presented via summary text and discussion. There are 12 programs with eight or more assessments[32] and four programs with between four and seven assessments.[33]

Table 5-9 below summarizes assessment results for the third party and new construction programs. The cells highlighted in darker grey indicate performance 'below average'. Cells highlighted in lighter gray indicate areas of 'above average' performance. Un-shaded cells with

[32] These include four third party programs, three new construction, four statewide partnerships and one Core program (PG&E Pump Energy Efficiency Services).

[33] These include two statewide partnerships, one local government partnership and one third party program.

entries represent more typical or average performance, where cells with no entry indicate that there were not enough entries to assess performance for that issue and that program or program group. For convenience and comparison purposes, the average results across all assessments are shown in the last column on the right.[34]

Table 5-9: Third Party Programs and PG&E Pump Energy Efficiency Services, Percent Receiving a "Poor" Assessment Outcome

Key Issue Assessed	SDG&E BID	PG&E Heavy Industry	PG&E Global	PG&E REEP	PG&E Pump Energy Efficiency Services	All Assessments Average (over all 300 LRAs)
Number of Assessments	19	9	10	10	9	
Project Documentation and Specification						
IOU Application Documentation Complete and Accurate	47%	38%	10%	10%	22%	24%
IOU Tracking Data Complete and Accurate	32%	38%	40%	30%	13%	22%
Project utilized pre-installation M&V	59%	0%	40%	0%	0%	37%
Appropriate Baseline	24%	14%	0%	10%	0%	19%
Early Replacement Claim: Valid RUL / EUL Approach Used	38%	67%		80%	0%	35%
Appropriate Calculation Method						
Appropriate Impact Calculation Method	29%	22%	10%	0%	0%	18%
All Relevant Inputs Considered	25%	13%	0%	13%	0%	18%
Adequate Values for All Inputs	14%	0%	0%	0%	13%	19%
Project utilized post-installation M&V	63%	33%	20%	0%	0%	38%
Program Rule Compliance						
Measures are IOU Program Eligible	0%	0%	0%	0%	0%	1%
Measures Exceed Code or Industry Standard Practice	7%	0%	0%	0%		9%
Non-IOU Fuel and Ancillary Impacts of Project Properly Accounted for		60%				76%
Customer Installation Meets Program Rules	6%	25%	0%	10%	0%	10%
Total Number of Good Performing Key Issues	5	7	10	9	11	
Total Number of Poor Performing Key Issues	8	4	1	2	0	

[34] Note that this is not an average across programs or program groups, but average over all completed assessments.

Observations on Table 5-10 include the following:

- As noted above, each issue has an associated sample size that is not necessarily the same as the "number of assessments" shown in the first row. Results for any issue area that are based on fewer than five projects are removed from the results tables. Similarly, key issues are removed altogether from the table where no programs have five or more completed assessments.
- The PG&E Pump Energy Efficiency Services Program receives above average assessment scores. This program is an above average performer in every category for which it receives a score.
- The SDG&E BID program scores below average in eight issue areas, more than any other program examined. All five issues in the '*project documentation and specification*' category and three of the four '*appropriate calculation method'* issues receive below average scores. Particularly high rates of "poor" ratings are in the use of pre- and post-installation M&V. At the same time, the BID program scores well above average in program rule compliance.
- The PG&E REEP and Global programs generally perform above average. The assessment scores are above average in all areas, except in the completeness of IOU tracking data and –for REEP only—in the approach to RUL/EUL.
- The Heavy Industry Energy Efficiency Program shows a generally above average assessment outcome. Scores are above average in baseline selection and industry standard practice, among others. Areas of concerns include documentation, tracking data, and program rule violations.

A total of five assessments were completed for PGE 2187 Monitoring Based Persistence Commissioning. Overall, the assessment results are positive. This program has above average scores across the '*project documentation and specification*' area and performs near average in the '*appropriate calculation method*' category. The only potential area of concern was in 'exceeding code and industry standard practice', where two of the five applications received a 'poor' rating.

Table 5-10 below summarizes the assessment results for the Nonresidential New Construction programs run by PG&E, SCE and SDG&E. The SCG New Construction program received just two assessments and so it is not discussed here.

Table 5-10: New Construction Programs Performance, Percent Receiving a "Poor" Assessment Outcome

Key Issue Assessed	SCE NC	PG&E NC	SDGE NC	All Assessments Average
Number of Assessments	12	9	10	300
Project Documentation and Specification				
IOU Application Documentation Complete and Accurate	42%	11%	20%	24%
IOU Tracking Data Complete and Accurate	0%	0%	20%	22%
Appropriate Baseline	36%	0%	10%	19%
Appropriate Impact Calculation				
Appropriate Impact Calculation Method	27%	0%	0%	18%
All Relevant Inputs Considered	30%	0%	22%	18%
Adequate Values for All Inputs	25%	25%	0%	19%
Project utilized post-installation M&V	75%	11%	40%	38%
Compliance With Program Rules				
Measures are IOU Program Eligible	0%	0%	0%	1%
Measures Exceed Code or Industry Standard Practice	0%	0%	0%	9%
Customer Installation Meets Program Rules	11%	0%	0%	10%
Total Number of Good Performing Key Issues	4	9	7	
Total Number of Poor Performing Key Issues	6	1	1	

Observations on Table 5-12 above include the following:

- Both PG&E and SDG&E's NR New Construction programs have above average performance.
- SCE's program performance is below average.[35] Areas of concerns for SCE's program include project documentation, baseline selection, and post-installation M&V. None of the issues within *'appropriate calculation method'* score well. However, SCE's program has an above average showing in the '*compliance with program rules'* area as well as for IOU tracking data.
- The PG&E NR New Construction Program has well above average assessment results. Results show there is no cause for concern in '*project documentation and specification',* where all the scores are among the best recorded for an individual program. Scores in *'program rule compliance'* are also well above average. Although it is a cause for concern in a couple applications flagged for the assignment of adequate input variables,

[35] Interestingly, the only New Construction program submitted by the IOUs as a 'program of interest' is the SCE NC program.

the '*appropriate calculation method'* area overall is also well above average. It scores well above average in the appropriate use of post-installation M&V.

- The SDG&E New Construction program also posts above average results. SDG&E's program scores well above average in baseline selection and in the '*appropriate calculation method*' area (where it receives well above average scores in for method selection and for assigning adequate values to calculation inputs). The use of post-installation M&V is average. SDG&E's program is well above average with respect to 'program rule compliance'.

Table 5-11 below summarizes the performance of four statewide partnership programs. The programs fall into the California Community College and UC/CSU institutional partnership categories.

Table 5-11: Statewide Partnership Programs' Performance, Percent Receiving a "Poor" Assessment Outcome

Key Issue Assessed	SCE CCC	SCE UC CSU	PG&E UC CSU	SCE CCC –L	All Assessments Average
Number of Assessments	12	9	11	12	300
Project Documentation and Specification					
IOU Application Documentation Complete and Accurate	42%	56%	36%	40%	24%
IOU Tracking Data Complete and Accurate	0%	33%	0%	20%	22%
Project utilized pre-installation M&V	-	71%	38%	50%	37%
Appropriate Baseline	36%	0%	11%	40%	19%
Early Replacement Claim: Valid RUL / EUL Approach Used		17%	0%	13%	35%
Appropriate Calculation Method					
Appropriate Impact Calculation Method	27%	29%	13%	33%	18%
All Relevant Inputs Considered	30%	17%	25%	22%	18%
Adequate Values for All Inputs	25%	40%	29%	20%	19%
Project utilized post-installation M&V	75%	33%	27%	40%	38%
Compliance with Program Rules					
Measures are IOU Program Eligible	0%	0%	0%	0%	1%
Measures Exceed Code or Industry Standard Practice	0%	14%	10%	11%	9%
Customer Installation Meets Program Rules	11%	0%	10%	10%	10%
Total Number of Good Performing Key Issues	3	5	7	2	
Total Number of Poor Performing Key Issues	4	6	1	4	

Observations on Table 5-11 above include the following:

- Overall, performance for the four institutional partnerships in the table is mixed. It is strongest in '*compliance with program rules*' and weakest in '*appropriate calculation method*'.

- All four programs score above average for their approach to RUL/EUL and most have above average scores with respect to IOU tracking data.
- All four programs are below average in their application documentation.
- PG&E UC/CSU has above average scores across nearly all components of the '*project documentation and specification*' area
- Both of the SCE CCC programs receive below average scores for selection of appropriate baseline and use of post-installation M&V.
- Both PG&E and SCE UC/CSU programs receive above average scores for selection of appropriate baseline and use of post-installation M&V.
- SCE UC/CSU has below average scores in a number of areas: project documentation, IOU tracking data, the use of pre-installation M&V, and assigning adequate values for input variables. Overall, this program's assessment results warrant some concern or follow up.

There are three partnership programs that received between four and five completed assessments each: the PG&E DGS[36] Partnership, the SCE DGS Partnership, and the PG&E San Francisco Energy Watch Program.

- The PG&E and SCE DGS each have an overall average performance. They both have notably below average scores in the use of pre- and post-installation M&V, in selecting the appropriate calculation method, and assigning adequate values to input variables. They both are above average with respect to '*program rule compliance'* and most areas of '*project documentation and specification'*.
- PG&E SF Energy Watch also had a below average showing with respect to pre- and post-installation M&V, and below average selection of appropriate calculation method. Other than those items, the SF Energy Watch program posted above average results.

Results for IOU Group Domains

Assessment results for IOU-specific sampling domains are shown in Table 5-12 below. Results are shown for:

- SCE local government ("Energy Leader"),
- PG&E local government ("Energy Watch"),
- PG&E Retro Commissioning (RCx) group,[37]

[36] Department of General Services Partnership

[37] Although RCx was not intended as an IOU-specific domain, all of its member programs are within PG&E territory.

- Other SCE 3P—a catch-all third party domain, and
- Other PG&E 3P—a catch-all third party domain.

Note that both SCE and PG&E "Other 3P" categories represent 3P programs *not* sampled at the program level.

Table 5-12: IOU-Specific Domain Performance, Percent Receiving a "Poor" Assessment Outcome

Key Issue Assessed	RCx	Other 3P SCE	Other 3P PG&E	PG&E LG "Energy Watch"	SCE LG "Energy Leader"	All Assessments Average
Number of Assessments	8	10	11	9	9	300
Project Documentation and Specification						
IOU Application Documentation Complete and Accurate	13%	20%	27%	25%	44%	24%
IOU Tracking Data Complete and Accurate	0%	10%	36%	25%	22%	22%
Project utilized pre-installation M&V	25%	20%	36%	67%	38%	37%
Appropriate Baseline	13%	25%	30%	17%	25%	19%
Early Replacement Claim: Valid RUL / EUL Approach Used			86%	17%	20%	35%
Appropriate Calculation Method						
Appropriate Impact Calculation Method	13%	11%	0%	17%	22%	18%
All Relevant Inputs Considered	13%	44%	36%	0%	13%	18%
Adequate Values for All Inputs	13%	30%	18%	0%	22%	19%
Appropriate non-HVAC Interactive Effects Calculation Method			25%			
Project utilized post-installation M&V	0%	10%	27%	67%	44%	38%
Compliance with Program Rules						
Measures are IOU Program Eligible	13%	10%	0%	0%	0%	1%
Measures Exceed Code or Industry Standard Practice	38%		20%	17%	11%	9%
Customer Installation Meets All Program Rules	13%	11%	18%	20%	0%	10%
Total Number of Good Performing Key Issues	8	6	4	3	6	
Total Number of Poor Performing Key Issues	3	4	**7**	4	2	

Observations on Table 5-12 above include the following:

- The RCx program group has well above average performance in all areas except the program rule compliance area, which is of some concern.
- The Energy Watch program group scores well for most issues within the '*appropriate calculation method*' area, and below average for most issues within '*program rule compliance'*. Scores are notably below average in pre- and post installation M&V.
- The SCE Energy Leader group has an above average showing for a number of categories. Scores are above average in all components of the '*program rule compliance'* and '*appropriate calculation method*' areas. The group does have areas of concern in project documentation and baseline selection.
- The "SCE Other 3P" group receives above average marks in most issues comprised by the '*project documentation and specification*' category. The group receives below average scores for baseline selection and calculation inputs (consideration of all relevant inputs, and the assignment of adequate values to those inputs).
- The "PG&E Other 3P" group receives below average scores in seven key issue areas. Overall, the scores for this group warrant some concern and potential follow up, particularly in the approach to EUL/RUL, selection of baseline and most issues within the '*program rule compliance*' area. The group received above average scores in four issue areas, including use of pre- and post-installation M&V and calculation method selection.

5.3.5 Results for Statewide Domains

This section presents results for the statewide sampling domains, which include the four institutional partnership groups: CCC,[38] UC/CSU,[39] CDCR,[40] and DGS.[41] Table 5-13 below summarizes results for the statewide sampling domains. For comparison purposes, results for all the statewide institutional partnerships together ("SGP") are shown in the table. Only three assessments were completed for CDCR, so this group is excluded from this analysis, except as they are represented within the "SGP" group.

[38] California Community College Partnership

[39] University of California and California State University Partnership

[40] California Department of Corrections Partnership

[41] California Department of General Services Partnership

Table 5-13: Statewide Domain Performance, Percent Receiving a "Poor" Assessment Outcome

Key Issue Assessed	UC/ CSU	DGS	CCC	GP	All Assessments
Number of Assessments	20	9	19	51	300
Project Documentation and Specification					
IOU Application Documentation Complete and Accurate	45%	22%	42%	39%	24%
IOU Tracking Data Complete and Accurate	16%	22%	16%	16%	22%
Project utilized pre-installation M&V	53%	67%	47%	55%	37%
Appropriate Baseline	6%	13%	32%	20%	19%
Early Replacement Claim: Valid RUL / EUL Approach Used	8%	0%	25%	14%	35%
Appropriate Calculation Method					
Appropriate Impact Calculation Method	20%	33%	28%	29%	18%
All Relevant Inputs Considered	21%	0%	22%	20%	18%
Adequate Values for All Inputs	33%	43%	29%	38%	19%
Appropriate non-HVAC Interactive Effects Calculation Method			0%	0%	9%
Project utilized post-installation M&V	30%	56%	37%	39%	38%
Compliance with Program Rules					
Measures are IOU Program Eligible	0%	11%	0%	2%	1%
Measures Exceed Code or Industry Standard Practice	12%	0%	11%	11%	9%
Customer Installation Meets All Program Rules	5%	11%	11%	10%	10%
Total of Good Performing Key Issues	**5**	**5**	**3**	**3**	
Total of Poor Performing Key Issues	**3**	**5**	**5**	**6**	

Observations on Table 5-13 above include the following:

- The UC/CSU group has above average performance in 6 issue areas, including selection of appropriate baseline and treatment of RUL/EUL. Still, there are a couple of mentionable areas for concern, including application documentation and assigning adequate values to inputs.
- DGS displays above average performance in five categories, including selection of baseline, EUL/RUL approach, and project documentation. Areas of concern include the use of pre- and post-installation M&V, and some of the issues related to '*appropriate calculation method*'.
- The CCC partnership exhibits mixed performance when compared with average scores. Scores indicate some areas of concern in the '*appropriate calculation method*' area, as

well as project documentation and selection of baseline. Scores in pre- and post-installation M&V are average.

5.3.6 Results by IOU

This section presents results by IOU. The sample sizes by utility range substantially, with only 27 for SCG and 145 for PG&E. Smaller sample sizes yield a higher expected variance, and smaller representation in the overall distribution of scores. It is expected that SCE and PG&E will have more scores in the "average" range than SCG and SDG&E simply because they make up a large portion of the overall sample. Cells and key issue rows with disproportionately small samples have been removed from results presented in Table 5-14.

Table 5-14: IOU Performance, Percent Receiving a "Poor" Assessment Outcome

Key Issue Assessed	IOU				
	SCG	SDG&E	SCE	PG&E	All Assessments Average
Number of Assessments	27	39	87	145	300
Project Documentation and Specification					
IOU Application Documentation Complete and Accurate	7%	36%	30%	21%	24%
IOU Tracking Data Complete and Accurate	33%	23%	15%	24%	22%
Project utilized pre-installation M&V	68%	57%	37%	25%	37%
Appropriate Baseline	30%	31%	22%	13%	19%
Early Replacement Claim: Valid RUL / EUL Approach Used	31%	37%	33%	37%	35%
Appropriate Calculation Method					
Appropriate Impact Calculation Method	30%	19%	22%	12%	18%
All Relevant Inputs Considered	19%	23%	19%	15%	18%
Adequate Values for All Inputs	37%	13%	21%	15%	19%
Project utilized post-installation M&V	70%	51%	41%	26%	38%
Compliance with Program Rules					
Measures are IOU Program Eligible	0%	0%	1%	1%	1%
Measures Exceed Code or Industry Standard Practice	25%	3%	6%	8%	9%
Non-IOU Fuel and Ancillary Impacts of Project Properly Accounted for (Cogen/Waste Heat Recovery/ Refinery Gas, etc.)	(small sample)	(small sample)	88%	74%	76%
Customer Installation Meets Program Rules	12%	6%	6%	12%	10%
Total Number of Good Performing Key Issues	2	4	3	7	
Total Number of Poor Performing Key Issues	8	6	2	2	

Observations on Table 5-14 above include the following:

- PG&E has markedly above average performance in a number of issue areas. They are above average in baseline selection, appropriate impact calculation method, and the use of pre- and post-installation M&V. Notable area of concerns for PG&E include approach to RUL/EUL and in the 'customer installation meets all program rules' issue.
- SCE has above average performance in the '*compliance with program rules'* area and in IOU tracking data. Performance in other areas, except for appropriate baseline and non-IOU/ancillary impacts area, is average when compared across all assessments.
- SDG&E is below average in eight of the performance categories, including three categories within the '*project documentation and specification*' area, with particular concern in the use of pre-installation M&V, application documentation and selection of baseline. Performance in the '*compliance with program rules*' category is above average. Calculation methods get above average marks for assignment of adequate input values but falter in the use of post-installation M&V.
- SCG has notable issues of concern within each of the three assessment categories. Pre- and post-installation M&V stand out as particularly far afield. Other mentionable areas of concern include IOU tracking data, selection of appropriate impact calculation method and assigning adequate values to calculation inputs.

6

Findings and Recommendations

Key findings and associated recommendations are presented in this chapter. Findings and recommendations are organized into topical areas in each of the sections that follow.

6.1 IOU Project Documentation

The evaluation to date has identified problems associated with IOU documentation. Evaluation requests for "all relevant project documentation" were inadequate or incomplete.

Finding: Lack of documentation on savings calculations is a gap observed in several contexts. Commonly observed problems include:

- Savings calculations for projects, measures and sub-measures were not provided.
- Calculations were provided via paper documents, locked spreadsheets, or spreadsheets with the functions stripped and replaced with static values. This did not enable reviewers to fully understand calculation methodologies, validate supporting equations, and update energy savings using verified inputs (if appropriate).
- For multi-measure projects, intermediate components of the final savings estimates were not apparent.

These issues hampered the evaluation effort and suggest that IOU documentation processes and procedures need significant improvements. Lack of complete documentation leads to costly and time consuming delays in completing ex post impact evaluation.

> **Recommendation**: As part of project closeout, the IOU, or third party implementer should make certain the source of final measure savings is clearly identified, stored and made available in the project archive. For additional control and standardization, we suggest using a "final closeout report". Such a report could be developed with IOU and ED input. In addition to final measure savings documentation, this form/report should also identify all fields needed for the program tracking database or ensure that all program forms, files and data are accounted for and properly stored for later retrieval. The present post retrofit inspection forms and other forms are unable to clearly identify

what documentation is available for a project (and also what documentation is not available).

Finding: Pre- and post-installation inspection records are often not provided or are cursory when provided. Moreover, many inspection records do not reflect measured values. There are exceptions, including certain third party programs that perform very well in this area. Outside of these exceptions, often critical impact inputs are not available or are not well documented. As a result the following occurs:

- The baseline specification is not evident;
- Equipment and/or systems efficiency specifications are not evident; and
- Valuable operating data are missing for the pre- and/or post-retrofit periods.

More certain ex post project savings results can be developed less expensively from improved documentation in this area.

Recommendation: As part of the IOU project review process, additional checks are needed to ensure the pre- and post-installation reports are complete and well organized. The reports should be reviewed to ensure inclusion of efficiency and operating data, such as hours of use, motor kW draw.

While it is true that smaller projects may not require or warrant measurement in all cases, all inputs used to estimate savings should be available for review and referenced. It is also ED's position that, at a minimum, parameter(s) unique to a given application should be used in custom (or non-deemed) measure savings estimates and that all parameters cannot be deemed or from secondary sources alone.

An IOU framework for M&V methods, requirements and documentation is not apparent. Improvement is needed on the part of the IOU's in the area of developing a framework and procedures that drive the level and emphasis of M&V that should be applied to a given project, subject to the following, and other, considerations:

1. An emphasis be placed on measurement and documentation of unique project-specific parameters that are likely to reduce uncertainty;
2. Larger projects be subject to greater levels of M&V and IOU review/scrutiny;
3. M&V approach should address project complexity and focus on parameters with the greatest potential for uncertainty reduction;
4. Special attention be given to measures associated with the use of non-IOU fuel, on-site generation or fuel switching;

5. M&V approach should consider the perceived level of risk to IOU claimed savings; and
6. Framework and procedures must address the need to maintain program cost-effectiveness.

Finding: Discrepancies are sometimes observed between the tracking data and the reported savings in the IOU documentation. It can be difficult to trace savings from the project documentation through to the tracking system, and in some cases impossible to reconcile the savings estimates. For example, in one case the IOU had discounted project savings in the tracking system by 40% versus the project documentation, and this discount was not mentioned anywhere in the documentation.

> **Recommendation:** Savings estimates in the project documentation should always match those in the tracking system. Documentation should be thoroughly checked and cross verified with the tracking system figures before sending files to the evaluators. Any 'discounts' applied to project savings should be supported with documentation.

Finding: Multiple and iterative data requests are often needed to obtain required data, and even then these have been known to remain ultimately unfulfilled. In some cases the same information was simply resent by an IOU following ED's notification that the original deliverable was insufficient. These iterations are costly and inefficient for all parties and result in delays in evaluation efforts. It appears the IOUs do not adequately review data request responses for comprehensiveness and accuracy.

> **Recommendation:** The IOUs should undertake a thorough QA/QC review of all data deliveries to ensure complete and robust data are provided to ED. Are the data in a usable format? Are the data consistent with tracking system claims and if not why not, or are other more accurate data available that need to be assembled for delivery? Is the information provided in an organized way that can be readily understood by the evaluator?

> **Recommendation:** Data responses from the IOUs should indicate clearly when the data requested is not in the possession of the utilities, their implementers, or other parties under IOU management.

Finding: Project documentation sometimes lacks clarity with respect to the scope of a given project. Project documentation received from the IOUs in response to initial data requests is sometimes not complete in terms of clearly describing the project and aligning with the savings estimates that are shown in the tracking data. In some cases, IOU documentation is hard to follow with multiple versions of the same form, unclear timelines, equipment specifications are

lacking, and no one 'final' set of calculations or savings estimates is provided. Participants, as part of the initial site planning or during the site visit, were often able to provide more thorough project documentation, which should have been originally provided to the IOU in fulfillment of the data request.

While problems related to data request responses were numerous, a couple additional noteworthy issues are mentioned here.

1. Supporting project documents from the IOU submittal for whole building projects was sometimes absent. The missing information includes as-built mechanical drawings, equipment specifications, cut sheets and light plans.
2. Tracking system data and application paperwork do not always clearly state if the demand savings (kW) for electric measures are estimated or have been determined to be zero. The same is true for potential gas savings attributable to electric-centric projects.

   Recommendation: The IOUs should maintain and provide detailed project scope and complete documentation for all projects. Independent parties, such as evaluators, should be able to clearly understand each project and be able to trace key project documentation back to the tracking system.

   Recommendation: Quality control checks should be performed on all accepted applications, and also between program administrators and database personnel to ensure consistency and accuracy of reporting.

Finding: Project documentation provided by the IOUs to evaluators is composed of a diverse mix of electronic and hard copy data. Sometimes data are provided to evaluators in inappropriate formats, such as metering data in a pdf. It appears that more project documentation is available in electronic format from the IOUs than in previous program cycles.

> **Recommendation**: As a general guideline, all project documentation should be compiled in one electronic location. Formats for data storage should optimize the usefulness of the data source to a variety of potential users. This approach supports ease of transfer and use, as well as addressing both environmental and security concerns.

Finding: Project applications sometimes involve more than one location, such as a set of retrofits for a chain store or restaurant. When the retrofits and savings differ from location to location, this approach may be problematic.

> **Recommendation**: If the retrofit performed is homogenous across locations then the approach of consolidated reporting is sound and a good time-saving measure, though store-by-store level data documentation is often still needed. If, however, the retrofits

involve different sets of measures at different locations or other complicating cross-location features, then it may be more appropriate for the IOUs to process unique applications for each location.

Finding: For some projects a single set of hard copy documents were assembled, such as a single application, but then split out into multiple applications in the tracking system, usually associated with different locations. In some instances the hard copy included inadequate information supporting the split out in the tracking system. This leads to a situation when evaluators seek to discuss a single application/location with the appropriate customer representative, but lack specifics on the retrofit activity at a given customer location – such as number of or type of measures installed (e.g., motors, VSDs, heat exchangers, etc.)

Recommendation: All tracking and related documentation systems should be fully transparent with respect to the retrofit activity completed.

6.2 IOU Project Tracking

Finding: Not all projects, measures and submeasures are clearly identified in the project documentation and in the tracking system. This was especially evident in New Construction projects using building simulation models, such as Savings by Design projects, and retrocommissioning / MBRCx (monitoring based retrocommissioning) projects.

Recommendation: As part of post inspection closeout, the IOU or third party implementer, or both, should make certain that all measures are clearly identified in the post-installation inspection reports. The IOU should further ask that project descriptions be complete and accurately conveyed to the tracking department. It is further recommended that unique measures be input as individual records in the IOU tracking systems.

Finding: Sometimes the paid incentive exceeds the capped percentage of the appropriate project cost parameter.

Recommendation: The IOUs should document and record project cost, including, where relevant, the incremental cost. These costs parameters should be sourced and well documented prior to entry into the tracking system. It is notable that recording of cost parameters is an area where significant improvement is needed. Associated baseline specification – early retirement, replace on burnout, natural replacement and add-on measure, for example – and the appropriate related recording of cost parameters should be an area for concentrated IOU improvement on a forward-going basis.

6.3 IOU Project Baseline Specification

Finding: IOU baseline specification practices used for measures and within programs were found to not be consistent with the evaluators' approaches.

> **Recommendation**: The IOUs should mount a concerted effort to adopt baseline specification practices in conformance with Decision 11-07-030 and CPUC policy. ED is now working with the IOUs through the ex ante review process to improve this and other within-program practices.

Finding: Baseline specifications for data center projects were inconsistent with PG&E's Data Center baseline document. Also, liberal assumptions were made regarding data center usage which increased the ex ante savings estimates.

> **Recommendation**: Savings calculations should be based on current baseline information and the current occupancy/load of the building, not with the future load forecasted for a facility's operations.

6.4 IOU Project Impact Estimation and Modeling

Finding: Significant challenges exist in using building modeling for whole building analysis. Ex-post and ex-ante savings were observed to vary substantially. There are many variables in these models, and for new construction projects in particular, a trued up calibrated model based on energy bills and interval data are factors that help to reduce discrepancies.

Furthermore, models need to incorporate available building parameters. For example, for sites using Energy-Pro for whole building analysis:

- All models defaulted to standard T-24 schedules instead of best representing the as-built conditions;
- None of the models were calibrated to actual building operating conditions; and
- Some of the energy model set ups did not match the actual system configuration of the building.

These factors also had a significant effect on the accuracy of savings estimates for whole building projects.

> **Recommendation**: The IOUs should work with ED to define appropriate impact estimation approaches with respect to whole building modeling.

Simulation models should incorporate the as-built building schedule instead of standard Title-24 schedules, and calibrate the model based on post installation inspection configurations and post-installation utility usage data. The extent of data applied for calibration must be weighed against the needs for timely reporting. Adjustments and supporting documentation for as-found occupancy of the building, as well as long-term pro-forma occupancy rates should be clearly detailed.

Over time it may be possible to accumulate a body of reliable as-found conditions for new construction projects and use that information to inform default occupancy rates and schedules. With such data in hand it would be possible to develop ED and IOU agreed upon parameters for use in new construction simulation models, and thereby replace Title-24 default schedules.

Finding: Sometimes the energy model provided by the IOU for review is not the final model: In a number of projects, simulation models such as eQuest or EnergyPro are used to develop ex ante savings. For some of these projects, the models that were provided as part of project analysis and documentation do not reproduce the final savings estimates when re-run.

Recommendation: IOUs should provide the final version of the energy model and simulation tool so that the recipient can easily reproduce IOU results.

Finding: Inappropriate calculation methods were used to estimate the savings for MBRCx projects. IOUs used IPMVP Option C to estimate the savings with as few as two months of pre and two months of post-installation usage data. MBRCx projects involve a variety of measures and have complicating factors such as measure interactive effects, weather dependent versus non weather dependent measures, and non-program energy-altering changes. For these reasons a whole building weather normalized approach is not always an appropriate technique to quantify savings. Option C is most useful when 12 months of pre- and post-installation billing data are available, expected savings represent 5% or more of building energy use, and normalization procedures will yield accurate adjustments to baseline consumption.

Recommendation: Until such time as IOUs can develop better savings calculation methodologies in concert with ED for these types of projects, the IOUs should, when proceeding with MBCx projects, base ex-ante savings on engineering analysis of measures implemented, with consideration of the above mentioned complicating factors. Extra attention is needed to identify and apply an appropriate M&V approach.

6.5 IOU Project Verification

Finding: Even when large quantities of data are provided for IOU project review, and even when the project is reviewed by knowledgeable and competent IOU staff and contractors, on-site

verification is sometimes required to ensure a thorough QA/QC process. On-site visits are effective for identifying baseline issues and can reveal issues such as fuel switching. Several of the evaluated projects included documentation that suggested that the IOU internal staff reviewer did not conduct an on-site visit or other post retrofit activities that could have identified potential issues that can put savings claims at risk.

> **Recommendation**: On-site verification is an important tool to be applied in an optimized fashion by the IOUs. One key factor driving the need for on-site verification is risk management. There are certain project characteristics, customer characteristics and other factors that should be used by the IOUs to assess risk and trigger on-site verification. For example, self-sponsored projects where non-IOU fuels, cogeneration, and/or energy transportation are involved, should require pre- and/or post-installation M&V and require detailed documentation.

Finding: The IOU project review process can be successful in uncovering errors in the input values; in some cases the error shows up as a discrepancy between the pre-installation and post-installation reports. In one such case, the M&V site visit later confirmed that air compressor pressure was not reduced as originally specified in the application, and zero savings resulted for that particular measure.

> **Recommendation**: As an additional step in the IOU internal quality control review process, IOUs should identify projects with significant discrepancies between the initial specifications or savings claims on the application (or pre-installation review report or energy audit) and the final application or post-installation review report. Following this, the IOUs should then assign projects undergoing major changes during the application process to a "certainty stratum" to receive on-site verification and M&V activities.

6.6 LRA Evaluation

Results of the lower rigor assessments exhibit the general patterns bulleted below. The reader should note that ‘lower rigor’ results are *qualitative* and not definitive. They do not necessarily correlate with or predict the outcome of rigorous M&V. Results summarized below can be considered as guidance for further investigation.

- Use of pre- and post-installation M&V is not consistently performed across the portfolio of custom projects. It is an area with much opportunity for improvement.
- New Construction programs appear adequate with respect to issues analyzed in the lower rigor assessments, with the exception of SCE’s Savings by Design, which appears to be l ‘below average’ in the areas of post-installation M&V and project documentation.

- PG&E third party industrial programs are above average in some areas: project documentation, baseline selection, calculation methods, and calculation input values. However, they were below average in the approach to RUL/EUL and in IOU tracking data.
- The SDG&E BID program was below average and may need improvement in use of pre- and post installation M&V, and project documentation.
- The statewide institutional partnerships[42] have uneven performance across the issues analyzed, and all exhibit a need for improved project documentation. The SCE CCC programs were below average in baseline selection and appropriate calculation methods. PG&E UC/CSU scores above average overall, though it is below average for calculation methods. SCE UC/CSU programs are below average, and in need of some improvement, particularly in project documentation and pre-installation M&V.
- For the PG&E RCx program group the LRA results are mixed. While project documentation, pre- and post- install M&V and calculation methods received above average scores, reviewers have cause for concern around measure eligibility and industry standard practice.
- PG&E local government program ("Energy Watch") exhibits need for improvement in the use of pre- and post-installation M&V, baseline selection, and adhering to standard practice guidelines and other program rules.
- SCE local government can improve in project documentation, pre- and post-install M&V, and selection of baseline.
- SCE "Other 3P" has above average scores in project documentation, tracking data, as well as pre- and post-installation M&V. However, these programs score below average in the treatment of calculation inputs and measure eligibility.
- For PG&E, the proper accounting of multiple IOU fuel impact and of non-IOU fuel / ancillary impacts is an area for potential improvement. PG&E scores below average in its approach to RUL/EUL claims. About one in four PG&E projects reviewed had problems related to IOU tracking data.
- SDG&E shows a need for improvement in project documentation and the approach to baseline selection and the use of pre- and post-installation M&V.
- SCG exhibits the need for improvement in their approach to baseline selection and the use of pre- and post-installation M&V.

Finding: Desk reviews are limited in their ability to properly identify and verify the baseline type, in-situ equipment efficiency, current operating conditions and other critical evaluation

[42] Partnerships include California Community Colleges (CCC), University of California/California State University (UC/CSU), Department of General Services (DGS), and California Department of Corrections (CDCR).

parameters. The determination of these issues can be substantially enhanced by operator / staff interviews and site visits, as may be needed to support a more detailed understanding of the systems affected.

> **Recommendation**: For any future lower rigor assessment effort, evaluators should supplement documentation review with phone interviews.[43] As a further enhancement, the efforts might also benefit from a subset of targeted site visits to fill in the most critical informational gaps. These enhancements to desk review were planned in this program cycle but not implemented to date.

Finding: The lower rigor process is useful for identifying major documentation lapses which often contribute to significant discrepancies in savings claims.

> **Recommendation**: Lower rigor assessments serve a valuable *qualitative* evaluation and feedback function. They should be interpreted with caution and used simply as guidance for further investigation. As always, rigorous M&V is needed to adequately formulate and quantify ex post evaluation estimates of savings.

6.7 Program Markets

Findings: The review of NTG scores by program suggests that certain market segments have either higher than average or lower than average net-to-gross ratios in those programs, affecting the resulting mean NTGR for certain programs. Some program-specific examples follow:

- PG&E Calculated Incentives Industrial Program (NTGR = 0.32)

  A key cause of the low NTGRs is the inclusion in the sample of several large pump-off controller (POC) projects on new oil wells undertaken by a major oil producer where decisions were made and approvals received in PY2006-2008. In that evaluation, it was well-documented that POCs on new oil wells installed by major oil producing companies are essentially standard practice and are assigned very low NTGRs. The main cause of this is the low incremental cost of a POC (around $2,000) versus the cost of drilling a new oil well (about $250,000). The PY2006-08 evaluation recommended that all of the IOUs discontinue incentives on new POC installations because of the low or zero reported program influence.

- PG&E Calculated Incentives Industrial Program (NTGR = 0.32)

[43] Although this evaluation did not integrate NTG survey results and conclusions in order to inform baseline review in the LRA, future lower rigor efforts should consider doing so.

Another root cause of the low NTGR for electric projects is low reported program influence for several sanitary district projects cutting across the three largest size strata.

- Local Government Partnership, PG&E Energy Watch Program (NTGR = 0.38)

  Local city and county projects reported low program influence in general, and two were among the largest size strata (stratum 3 projects). NTGRs for these types of projects ranged from 0.17 to 0.31.

- PGE20135: Pump Efficiency Services Program (NTGR = 0.39)

  Among the lowest NTGRs for this program were those for municipal water district projects. Many are in the 0.20 to 0.30 range.

- SCE Institutional Partnerships – Local Government (NTGR = 0.49)

  Two of the larger projects in this program group involved retrocommissioning / RCx of existing equipment by municipalities. These projects both had high NTGRs of 0.83. Retrocommissioning is not routinely done by these types of customers, according to NTG interviews. The potential for high program influence given these circumstances is much greater.

  Recommendation: Further investigation is needed into NTGR findings for relevant projects in markets showing high free ridership to assess whether decisions have already been made before the program becomes involved, and/or whether other drivers of free ridership/standard practice are present (such that some of the installed measures are becoming standard practice). Markets include sanitary districts, cities and counties and municipal water districts. It is acknowledged by the evaluation team that controlling free ridership rates in such a large portfolio of programs is a challenging undertaking, and that simple process changes and other modifications to business as usual may not be an effective solution.

  Recommendation: Following completion of the market assessment activities noted above, these findings should be integrated into program plans and designs.

Appendix A

Summary of Reasons for Discrepancy for Completed Projects

The prefixes in the Itron Record ID represent different IOUs (E for PG&E, F for SCE, G for SCG, and H for SDG&E). In the stratum column for each project, the stratum size (1-5) is provided along with an indicator of the fuel domain (e for electric, g for gas). Representative sizes of strata for various IOUs and fuel types can be gauged from similar strata in Appendix B. Secondary fuel impacts (i.e., gas savings for electric sites and electric savings for gas sites) are included to provide further information about projects.

Summary of Reasons for Discrepancy for Completed Projects

Itron RecordID	Measure / Site Type	Stratum	GRR - kW	GRR - kWh	GRR - Therms	Primary Reason for Discrepancy	Expanded Reasons for Discrepancy
E002	Heat Exchanger / Refinery	2 (g)			0.99	Oper. Conditions (OC)	Hours were slightly lower in ex-post calculations. Longer periods of data were used in the ex-post analysis.
E004	Steam to Electric Pump / Refinery	3 (g)			0.85	Oper. Conditions (OC)	Hours of use of the steam driven pumps replaced with turbine driven pumps are about 15% less in the e x-post calculations.
E006	Furnace Coating / Refinery	3 (g)			0.99	Oper. Conditions (OC)	Ex-post data verified longer hours of operation.
E007	Bleaching Process Improvement / Chemical Mftr	3 (g)			0.43	Oper. Conditions (OC)	Line #2 was not completely replaced as described in IOU documentation.
E009	VSDs, Well conversion, Low pressure systems / Oilfield	1 (e)		0.87		Oper. Conditions (OC)	Different production and compressor data resulted in lower ex-post savings.
E010	Hot/cold aisle airflow configuration / Data center	1 (e)	0.44	0.44		Inappropriate Baseline (IB)	Incorrect TSP baseline of 3.5 in WG was utilized. The appropriate baseline is 1.9 in WG. 53 AHUs were operating as compared to 75 AHUs.
E011	Automate Steam Flow / Refinery	3 (g)			0.76	Oper. Conditions (OC)	Unit efficiency (therm/unit of production) increase was not as great in the ex-post calculations' although production increased, ex-post savings were lower.
E012	Pressure Recovery Bypass / Refinery	1 (e)	0.98	1.01		Calc. Method (CM)	The IOU analysis used a theoretical model to estimate the savings impacts for the three feed cylinders only. ED's approach utilized data from the customer's SCADA system.
E013	Controls to Process Electric Heating / Mftr	4 (g)			1.50	Oper. Conditions (OC)	Maintenance downtime was not accounted for in the initial estimate.
E015	Steam Leak Repair / Refinery	4 (g)			0.69	Oper. Conditions (OC)	Some equipment non-functional, decommissioned, or continued experiencing leaks.
E016	Greenhouse - NC: Insulation, Heat Curtains, EE Blrs	4 (g)	0.04	0.16	0.93	Oper. Conditions (OC)	Metered data showed lower temperatures and smaller gas savings; changes in baseline construction increased ex-post savings, offsetting decreases from lower temperatures.
E017	POCs / Oilfield	1 (e)	0.14	0.13		Oper. Conditions (OC)	Higher post-installation run time and kW usage at the rod beam pumps caused much lower ex-post savings.

Itron RecordID	Measure / Site Type	Stratum	GRR - kW	GRR - kWh	GRR - Therms	Primary Reason for Discrepancy	Expanded Reasons for Discrepancy
E019	Aeration, DO control, VSDs, Pumps / WWTP	1 (e)	0.75	0.75		Oper. Conditions (OC)	The ex ante savings estimates were derived using design values for flow rates while the ex post calculations were made using longer term historic SCADA data.
E020	Optimize Process (and VSDs/motors) / Refinery	4 (g)	0.55	0.81	1.02	Inappropriate Baseline (IB)	Increase in new process system thermal efficiency; double counting of the electric efficiency improvements caused reduced electric ex post savings.
E021	Whole Building Retrofit / Healthcare Facility	4 (g)	58.49	1.14	0.05	Equipment Specification(ES)	Ex-post LPD was 0.859 W/ft2 vs. Ex-Ante LPD of 1.036 W/ft2. Ex-Post analysis calibrated the Energy-Pro model to building cooling load.
E024	New aerators, VFD Blowers and SCADA system / WWTP	1 (e)	0.28	0.27		Inappropriate Baseline (IB)	The new fine bubble aeration system is no more efficient than baseline for new construction/normal replacement, and blower run-time is less than expected due to new SCADA control system.
E025	Bypass Flow to Reduce Pumping / Oilfield	1 (e)	1.18	1.18		Oper. Conditions (OC)	No post installation data available. No historical data available. Period during site collection representative per facility contact.
E027	Improved Convection Section / Refinery	4 (g)			1.12	Oper. Conditions (OC)	ED used calculated values for furnace feed rate. IOU used measured charge rate which did not account for decrease in feed temperature.
E028	Improve Concentration process / Refinery	4 (g)			0.84	Oper. Conditions (OC)	Implementation of this measure has caused the production to increase at the SWC. Energy savings were adjusted for increase in production.
E030	Steam Traps / Refinery	4 (g)			0.91	Calc. Method (CM)	ED used Spirax Sarco methodology. IOU method unclear because did not submit energy savings calcs with a workable spreadsheet for ED review.
E031	New Motors, Pumps, Increased Pipe Size / Water Agency	1 (e)	1.18	0.22		Oper. Conditions (OC)	Ex-post hours significantly less ex-ante hours (forecasted over a long future timeframe). SCADA data for flow and VFD speeds were used in the ex-post calculations.
E034	POCs – New wells / Oil Wellfield	1 (e)	0.40	0.40		Oper. Conditions (OC)	Actual runtimes significantly different from ex ante expected runtimes.
E036	Steam Traps / Refinery	4 (g)			0.91	Calc. Method (CM)	ED used Spirax Sarco methodology. IOU method unclear because did not submit energy savings calcs with a workable spreadsheet for ED review.
E038	New Greenhouse (Envelope & Htg Measures)/ Nursery	4 (g)			0.94	Calc. Method (CM)	Building components / insolation values different in ex-post analysis; interactivity may not be fully accounted for in the ex-post analysis.

Itron RecordID	Measure / Site Type	Stratum	GRR - kW	GRR - kWh	GRR - Therms	Primary Reason for Discrepancy	Expanded Reasons for Discrepancy
E041	Comp. Air Modifications / Manufacturer	2 (e)	0.01	0.01		Oper. Conditions (OC)	Ex-ante indicated only the 400HP compressor would be required; ex-post both the 400HP and 450HP compressors were on a 99% duty cycle over 4 weeks.
E045	POCs/ Oil Wellfield	2 (e)	0.37	0.35		Oper. Conditions (OC)	A major contributor for the low realization rate was the actual runtimes of the sampled wells which was derived from SCADA data.
E053	MBCx Project / University	2 (e)	3.11	1.89	1.52	Oper. Conditions (OC)	Electric load shift due to fire in the building. Additional savings by elimination of continuous condensate leakage.
E054	VFD, EE Blowers, DO Control, Motors - WWTP	2 (e)	0.01	0.35		Inappropriate Baseline (IB)	Regressive baseline used which is less efficient than the pre-existing system.
E055	Gas lift to rod beam pumps / Oil Wellfield	3 (e)	0.74	0.70		Oper. Conditions (OC)	Utilization of measured data in conjunction with historic production data.
E056	Downsize Pump / Refinery	3 (e)	0	0		Oper. Conditions (OC)	Equipment not operating due to motor/pump failure and no date scheduled for repair and return to service.
E057	New VSD Air Compressors / Refinery	3 (e)	-6.11	-6.11		Inappropriate Baseline (IB)	Ex-ante baseline of an uncontrolled inefficient electric compressor although an existing gas powered engine-driven compressor fueled by non-IOU gas was actually in place. Load on the electric grid increased.
E059	Variable Speed Drives on Submersible Pumps / Oil Wellfield	3 (e)	-0.71	-0.71		Inappropriate Baseline (IB)	Ex-ante baseline of an uncontrolled electric pump with savings attributed to a VFD on that pump although an existing engine-driven pump fueled by non-IOU waste gas was actually in place. Load on the electric grid increased.
E060	New Construction / Greenhouse	5 (g)			0.92	Oper. Conditions (OC)	Building components and insolation values were different in the ex-post analysis, lowering savings; ex-post monitoring found higher temperatures, increasing savings.
E066	Pool Cover / School	5 (g)			0.39	Inappropriate Baseline (IB)	Incorrect baseline (no cover), neglected solar heating system, 83 % plant efficiency vs. ex post value of 78%. Ex-ante used Energy Smart Pools; ex-post used billing analysis / PRISM regression techniques.
E079	Constant to Variable Speed Chiller / Office	4 (e)	0.89	1.55		Oper. Conditions (OC)	The eQuest model corrected. Operating hours were longer for one efficient replacement chiller, increasing kWh impacts.

Itron RecordID	Measure / Site Type	Stratum	GRR - kW	GRR - kWh	GRR - Therms	Primary Reason for Discrepancy	Expanded Reasons for Discrepancy
E080	Whole Building Retrofit / Community College	4 (e)	0.14	0.38	0.95	Equipment Specification(ES)	Poor electric GRR due to changes in HVAC, AHUs, lighting, occupancy, chiller performance curves, etc.
E081	CO sensors on Garage fans / Commercial Building	4 (e)	0.42	0.42		Inappropriate Baseline (IB)	Two of four fan motors non-operational. Others are at lower load than n ex-ante calcs.
E084	New AHU, Packaged Units, VAV Conversion / Office	4 (e)		0		Ineligible Measure (IM)	Facility was non-operational and vacant.
E085	Whole Building Retrofit / Office Building	4 (e)	0.93	1.79	3.56	Oper. Conditions (OC)	Baseline annual electricity usage got doubled after the model calibrations. The heating option for each AC unit is changed from gas heating to no heating.
E086	Whole Building Retrofit /University	5 (g)	0.18	1.04	1.54	Oper. Conditions (OC)	Longer operating hours and better chiller efficiency than expected. Only one of two measures implemented.
E087	Rehab water pumps/ Municipal Water Agency	4 (e)	2.63	2.19		Oper. Conditions (OC)	Mandatory rationing policy was in effect in 2009 and hence the peak demand was less and the operational hours were lower than typical.
E089	Ozone Laundry Modification / Hotel	5 (g)			0.12	Oper. Conditions (OC)	System was not used to reduce hot water use in the ozone laundry measure.
E091	Whole Building Retrofit /University	5 (g)	0.64	4.49	4.51	Oper. Conditions (OC)	Operating schedules was changed from standard schedules to actual schedules. There was a reduction in chilled water demand than expected. Two 100% outside air units added to pre-cool the outside air (OA) using evaporative cooling from a cooling tower
E092	Boiler Economizer, Change Boiler Operation / Mftr.	5 (g)			0.19	Ineligible Measure (IM)	Shifting boiler load to an existing, more efficient boiler is an operating practice change, which is not eligible in retrofit programs.
E093	VSDs on Refrig. Evap Fans / Refr. Storage	4 (e)	2.01	2.54		Oper. Conditions (OC)	Lower speeds on VSDs and higher pre-retrofit kW use of motors led to greater savings.
E096	Whole Building Retrofit /Primary School	5 (g)	0.17	0.72	0.43	Oper. Conditions (OC)	Actual operating schedules were different from standard schedules implemented in the Ex-Ante model. The school is closed during the peak cooling month which wasn't taken in to account in the Ex-Ante model. Additionally, the efficiency of the chiller serving the Building C is lower than the Ex-Ante value.

Itron RecordID	Measure / Site Type	Stratum	GRR - kW	GRR - kWh	GRR - Therms	Primary Reason for Discrepancy	Expanded Reasons for Discrepancy
E097	VSDs on Irrigation Pump / Farm	5 (e)	0.80	0.67		Oper. Conditions (OC)	Pumps with VFD in this measure are used for two types of irrigation (sprinkler and furrow). Sprinkler irrigation requires a pump running at full speed, thus savings accrues only for furrow (flood) irrigation. A different calculation method was also used for ex post calculations.
E098	EE Boiler and VFD / Office bldg	5 (g)		0.90	0.67	Inappropriate Baseline (IB)	An inappropriate baseline (in situ vs. Title 24) was used for a very old boiler
E103	Whole Building Retrofit / Community College	5 (g)	0.11	0.40	0.35	Measure Count (MC)	The actual cooling system comprises DX units instead of central chiller plant system in the Ex-Ante model. The reported Ex-Ante savings are for both Building 1 and 2, while the evaluated project only covers Building 2. Additionally, the actual operating schedules were different from the standard schedules that were used in the IOU model.
E105	New Steam Condensate Heat Exchanger - Food Processing	5 (g)			0.84	Oper. Conditions (OC)	ED calculated operating hours using post-installation monitoring and adjusted for increase in production. IOU monitoring period was very short.
E106	Controls on Hot Water Pump / Office Building	5 (e)	0.93	0.84		Oper. Conditions (OC)	IOU assumed a single operating condition, where in actuality the VFD is continuously varying to meet the system requirements.
E109	Refrigeration Measures / Convenience Store	5 (e)	0.25	0.24		Calc. Method (CM)	ED performed engineering calculations to estimate the impacts of the fan motor controllers for the freezer and walk in cooler evaporators.
E111	ECM motors and Controllers / Grocery)	5 (e)	0.57	0.54		Oper. Conditions (OC)	One (of nine) small refrigeration system fan was not installed and two fan controllers to control the nine fans were not functional.
E113	EMS on HVAC / Retail Store	5 (g)	-0.13	1.17	5.23	Inappropriate Baseline (IB)	EIRs of the HVAC units are higher than expected. Additionally, the actual room temperature was lower than the ex-ante value
E118	EMS on HVAC / Retail Store	5 (g)	1.57	0.97	-0.93	Inappropriate Baseline (IB)	Actual room temperature was lower than the ex-ante value. EIRs of the HVAC units are higher than expected.
E119	EMS on HVAC / Retail Store	5 (g)	1.09	1.99	0.17	Inappropriate Baseline (IB)	Actual room temperature was lower than the ex-ante value.
E121	EMS on HVAC / Retail Store	5 (g)	0.26	2.70	9.69	Calc. Method (CM)	Building floor area and store hours changed. Ex-ante eQUEST model is a one-story building vs. ex post model with two stories.

Itron RecordID	Measure / Site Type	Stratum	GRR - kW	GRR - kWh	GRR - Therms	Primary Reason for Discrepancy	Expanded Reasons for Discrepancy
E122	Evaporator Fan Motors / Assisted Living	5 (e)	NA ex-ante=0	0.37		Calc. Method (CM)	ED used IOU workpapers for savings, resulting in lower savings. The vendor submitted calculations which claimed a less efficient baseline and higher savings.
E123	Compressed Air Controller / Winery	5 (e)		0		Inappropriate Baseline (IB)	Zero energy savings are assigned to this project as the project (an air pressure controller) was unsuccessful in reducing air pressure at the facility.
E124	Remote Thermostat System / Commercial bldg.	5 (e)		2.69		Oper. Conditions (OC)	The IOU savings were based on the average of 9 sample stores. The operating conditions were different than expected and savings were underestimated.
F004	VFDs for Boiler Fans / Manufacturer	1 (e)	0.26	0.26		Oper. Conditions (OC)	Ex Ante calculations based upon inaccurate production rates. IOU documentation matched on-site verified operational profile, but ex ante calcs used different data.
F006	New IMM and Blow molder / Plastics Mftr	1 (e)	0.67	0.62		Equipment Specifications (ES)	Baseline was chosen to be an existing electric/hydraulic IMM instead of the IOU hydraulic IMM (prescribed by SPC calculator tool)
F007	VFDs, Filters, Pipe Size Increase / Commercial Bldg.	1 (e)	0.42	0.40		Inappropriate Baseline (IB)	Ex-ante baseline pump efficiency was 59.75% vs. ex-post baseline efficiency of 88.5%. Ex-post pump head reduction was 8.2 ft vs. 31 ft ex-post.
F008	New Large Pumps / Oil Wellfields	1 (e)	0.23	0.26		Inappropriate Baseline (IB)	Measure inaccurately characterized as "System Optimization". New pump installed was not better than industry standard practice.
F018	Compr. Air Modifications / Mftr.	2 (e)	0.83	0.80		Ineligible Measure (IM)	Leak repair measures were disallowed, accounting for somewhat lower savings.
F019	New Fan Wheel - Large 2500 hp Application / Cement Mftr	2 (e)	1.07	0.67		Oper. Conditions (OC)	Incorrect assumptions for pre installation not accounting for post installation increased production, and incorrect number of operating hours.
F022	Compr. Air Modifications / Mftr.	2 (e)	0.16	0.16		Oper. Conditions (OC)	Actual post-retrofit measurements obtained from the compressed air system showed drastically reduced savings as compared to the IOU ex-ante forecast. Production was not an issue.
F024	Compr. Air Modifications / Mftr.	2 (e)	0.24	0.26		Calc. Method (CM)	Actual post-retrofit measurements led to reduced savings vs. ex-ante claims. Insufficient data to normalize for airflow or production.
F026	Compr. Air Modifications / Mftr.	3 (e)	0.57	0.57		Ineligible Measure (IM)	Leak repair measures were disallowed, accounting for somewhat lower savings.

Itron RecordID	Measure / Site Type	Stratum	GRR - kW	GRR - kWh	GRR - Therms	Primary Reason for Discrepancy	Expanded Reasons for Discrepancy
F027	Retrocommissioning / Hospital	3 (e)	4.40	0.95		Oper. Conditions (OC)	More systems were found to have reset schedules programmed than were modeled in the ex-ante simulation.
F028	Process Equt., Compressor Modifications / Mftr.	3 (e)	0	0		Oper. Conditions (OC)	Facility closed.
F036	HVAC Controls, VFD on AHUs / Light Industrial Mftr.	3 (e)	1.44	1.48		Calc. Method (CM)	Energy modeling ex-post vs. spreadsheet analysis ex-ante. Actual building is ~ 700,000 square feet but was modeled as 1,000,000 sf.
F042	Agric. Pump / Farm	4 (e)	N/A	0.24		Inappropriate Baseline (IB)	Unrealistic, very low baseline efficiency for pump in a state of disrepair was used.
F050	Compr. Air Modifications / Mftr.	4 (e)	1.00	1.00		No Discrepancies (ND)	No discrepancies noted.
F054	Whole Building Retrofit / School	4 (e)	0.25	0.60	0.67	Oper. Conditions (OC)	Actual HVAC operating schedule different from ex-ante estimate(less hrs/day). Incorrect method used to estimate peak demand.
F059	Agric. Pump / Farm	5 (e)	1.74	1.06		Oper. Conditions (OC)	Additional kWh savings resulted from increased usage of the pump systems. Ex-ante kW savings appeared to be underestimated and adjusted downward in the IOU reporting phases due to a spot reading vs. data over longer periods.
F061	Agric. Pump / Farm	5 (e)	0	0		Oper. Conditions (OC)	The well was abandoned and not in use.
F063	Demand control ventilation (DCV) on RTUs / Commercial Bldg. rooftop air handling units	5 (e)	0.62	0.64		Calc. Method (CM)	Ex-post RTU EER of 9.1 as compared to ex-ante EER of 10.0.
F064	ECM Motors / Supermarket	5 (e)	0.80	0.80		Measure Count (MC)	Ex-ante savings based on 53 ECM motors. Ex post based on 43 ECM motors as per info provided by contractor.
F066	Agric. Pump / Farm	5 (e)	0	0.99		Calc. Method (CM)	Slightly lower kWh savings resulted from decreased usage of the pump systems. Ex-ante kW savings was calculated but no peak demand reduction during the peak demand periods was noted on bills and kW savings was disallowed.
F069	Agric. Pump / Farm	5 (e)	1.06	1.01		Oper. Conditions (OC)	The discrepancies resulting from this report are from the slightly lower efficiency rating for OPE (58.4% vs. 58.6%).

Itron RecordID	Measure / Site Type	Stratum	GRR - kW	GRR - kWh	GRR - Therms	Primary Reason for Discrepancy	Expanded Reasons for Discrepancy
G001	Reconfigured Heat Exchangers / Refinery	1 (g)			0.44	Oper. Conditions (OC)	Production levels were much lower than assumed in the ex ante calculations.
G003	New Reboilers, Reconfigured Heat Exchangers / Refinery	2 (g)			0.74	Oper. Conditions (OC)	The longer monitoring period captured maintenance downtime that was not accounted for in the ex ante calculations.
G004	EE Juice Evaporator / Beverage Mftr	3 (g)			0.21	Inappropriate Baseline (IB)	Ex-ante baseline was least efficient piece of equipment. Vendor contact confirmed industry standard practice as a 5 effect vs. 3 effect evaporator, reducing savings. Production changes also reduced savings.
G008	Retrocommissioning / Hospital	3 (g)			2.73	Oper. Conditions (OC)	More systems were found to have reset schedules programmed than were modeled in the ex-ante simulation.
G009	Combustion controls / Refinery	3 (g)			0.86	Oper. Conditions (OC)	IOU claims based on 3 months DCS data for post installation period. Ex post calculations used longer term 2 year data resulting in reduction of ex ante gas savings.
G013	EE Boiler, Insulation, Backwash System, Pool Cover / Institutional	4 (g)			0.00	Ineligible Measure (IM)	The pool cover measure ineligible (standard practice), eliminating 41.5% of the claimed savings. Insulation measure not installed (3.2% reduction). EE boilers did not exceed baseline requirements (34.5% reduction)
G016	Improved Surface Insulation / Mftr.	4 (g)			0.35	Inappropriate Baseline (IB)	Ex-post baseline consists of more insulation than ex-ante baseline. Ex-ante baseline not properly defined. IOU used one set of data points; ED used 39 days time series data.
G017	Ozone Laundry / Textile Mftr.	4 (g)		NA	0.64	Oper. Conditions (OC)	Smaller efficiency increase; only pre-retrofit production used as basis for ex-post savings (no displacement of older less efficient units). Electrical savings were not included in the ex-ante but are credited ex-post.
G021	Heat Exchanger / Food Processor	4 (g)			-0%	Oper. Conditions (OC)	A new heat exchanger was installed to recover heat; this heat was already being used in the process. No net savings resulted; the new heat exchanger was less efficient.
G026	Burner Retrofit / Commercial Building	4 (g)			0.47	Inappropriate Baseline (IB)	Burner was not replaced; incorrect low ex-ante baseline efficiency. Differences methodologies utilized to estimate loads / savings. Heat exchanger measure operates at a 17°F delta-T as opposed to 36°F (ex-ante).
G038	Install Furnace Door Seals / Tank Mftr.	5 (g)			0	Inappropriate Baseline (IB)	Savings were zero as this door gasket in an industrial furnace was a normal maintenance repair.

Itron RecordID	Measure / Site Type	Stratum	GRR - kW	GRR - kWh	GRR - Therms	Primary Reason for Discrepancy	Expanded Reasons for Discrepancy
H001	Economizer for Heat Recovery / Laundry	2 (g)			0.61	Oper. Conditions (OC)	During the site visit ED determined that the facility is operating at 63.4% of the throughput estimated in the ex ante calculations.
H002	Whole Building Retrofit / Refrigerated Warehouse	1 (e)	1.48	1.10		Oper. Conditions (OC)	Operating schedule adjustments and calibration caused loads to change. Ex-ante assumed substrate cooling process took place at night; this process occurs during the day. Two more DX refrigeration systems operate during the day in the ex-post case.
H013	CO Sensors on Garage Fans / Institutional Bldg.	2 (e)	0	0		Ineligible Measure (IM)	Ineligible under the ESB program.
H015	MBCx Project (Pump VFDs, Chiller Optimization) / Light Manufacturing	2 (e)	0.70	0.72		Calc. Method (CM)	Ex-ante estimate used 1 month pre and 1 month; ex-post analysis based on 11 months post data. Reduction in cooling load has negative impact on savings.
H032	Whole Building Retrofit / Large Office	3 (e)		0.66	35.40	Oper. Conditions (OC)	The actual operation hours are lower than ex-ante schedule. The actual relief fan power is much lower than the ex ante value. Ex-post U-factor of glazing is lower than the ex ante values.
H034	Whole Building Retrofit / Hospital	4 (e)		0.54		Oper. Conditions (OC)	Ex-post operating schedule different than ex-ante schedule. Hot water supply disconnected from AHU heating coil. Ex-ante model was not calibrated.
H042	CO Sensors on Exhaust Fans / Garage	5 (e)	0.70	0.61		Oper. Conditions (OC)	The ex-ante motor load factor assumption of 0.9 whereas the ex-post load factor was 0.5. There was difference between ex-Ante and Ex-Post fan operating hours.

Appendix B

Itron, ED and IOU Project Identifiers; Strata; and Ex-ante / Ex-post Savings for Completed Projects

The prefixes in the Itron Record ID represent different IOUs (E for PG&E, F for SCE, G for SCG, and H for SDG&E). In the stratum column for each project, the strata size (1 - 5) is provided along with an indicator of the fuel domain (e for electric, g for gas). Secondary fuel impacts (i.e., gas savings for electric sites and electric savings for gas sites) are included to provide further information about projects.

Itron, ED and IOU Project Identifiers; Strata; and Ex-ante / Ex-post Savings for Completed Projects

Itron RecordID	ED Claim ID	IOU Application Code	Measure / Site Type	Ex-ante kW Savings	Ex-ante kWh Savings	Ex-ante Therm Savings	Stratum	Ex-post First Year kW Savings	Ex-post First Year kWh Savings	Ex-post First Year Therm Savings
E002	5029826	2K09016091	Heat Exchanger / Refinery			4,310,537	2 (g)			4,247,199
E004	4401648	2K08009019	Steam to Electric Pump / Refinery			3,253,989	3 (g)			2,756,592
E006	5033047	2K10042682	Furnace Coating / Refinery			2,588,024	3 (g)			2,556,869
E007	4646889	2K09027855	Bleaching Process Improvement / Chemical Mftr			2,241,513	3 (g)			954,249
E009	4569894	TAA0006395	VSDs, Well conversion, Low pressure systems / Oilfield		6,647,011		1 (e)	0	5,750,460	
E010	5077594	2K09020022	Hot/cold aisle airflow configuration / Data center	718	6,288,204		1 (e)	316.2	2,770,111	
E011	6061930	TAA0008203	Automate Steam Flow / Refinery			1,040,884	3 (g)			785,485
E012	6050405	TAA0008165	Pressure Recovery Bypass / Refinery	567.9	4,838,485		1 (e)	559.3	4,899,659	
E013	5191860	TAA0007266	Controls to Process Electric Heating / Mftr			900,251	4 (g)			1,354,872
E015	5011349	2K10032673	Steam Leak Repair / Refinery			825,413	4 (g)			567,959
E016	4324516	NC0057293	Greenhouse - NC: Insulation, Heat Curtains, EE Blrs	80	372,568	678,817	4 (g)	3.2	59,611	631,300
E017	4626714	2K09013224	POCs / Oilfield	690.05	6,591,550		1 (e)	122.4	1,324,589	

Itron RecordID	ED Claim ID	IOU Application Code	Measure / Site Type	Ex-ante kW Savings	Ex-ante kWh Savings	Ex-ante Therm Savings	Stratum	Ex-post First Year kW Savings	Ex-post First Year kWh Savings	Ex-post First Year Therm Savings
E019	4337870	NC0055313	Aeration, DO control, VSDs, Pumps / WWTP	413.1	3,618,736		1 (e)	311.8	2,731,255	
E020	4643702	TAA0006573	Optimize Process (and VSDs/motors) / Refinery	37	439,818	462,008	4 (g)	18.4	136,719	472,074
E021	4296131	NC0086654	Whole Building Retrofit / Healthcare Facility	3.5	1,389,499	352,362	4 (g)	204.7	1,580,496	18,537
E024	4585678	TAA0006466	New aerators, VFD Blowers and SCADA system / WWTP	354.6	3,106,296		1 (e)	100.9	836,795	
E025	4348453	TAA0005777	Bypass Flow to Reduce Pumping / Oilfield	528.36	4,535,997		1 (e)	624.9	5,364,749	
E027	4383909	2K08009499	Improved Convection Section / Refinery			434,452	4 (g)			487,941
E028	4556619	TAA0006372	Improve Concentration process / Refinery			433,231	4 (g)			365,565
E030	5158577	STPB000007	Steam Traps / Refinery			418,994	4 (g)			381,533
E031	5544494	NC0046731	New Motors, Pumps, Increased Pipe Size / Water Agency	575	3,327,613		1 (e)	795	866,509	
E034	4374283	NC0051396	POCs – New wells wells / Oil Wellfield	404.4	3,542,350		1 (e)	159.6	1,408,914	
E036	5199669	STPB000010	Steam Traps / Refinery			315,120	4 (g)			381,533

Itron RecordID	ED Claim ID	IOU Application Code	Measure / Site Type	Ex-ante kW Savings	Ex-ante kWh Savings	Ex-ante Therm Savings	Stratum	Ex-post First Year kW Savings	Ex-post First Year kWh Savings	Ex-post First Year Therm Savings
E038	4969628	NC0075773	New Greenhouse (Envelope & Htg Measures)/ Nursery			293,395	4 (g)			275,502
E041	5308149	TAA0007421	Comp. Air Modifications / Manufacturer	305.92	2,569,728		2 (e)	2.72	23,827	
E045	5205481	2K08008267	POCs/ Oil Wellfield	218.13	2,109,227		2 (e)	79.8	730,909	
E053	4764602	2K0701163C	MBCx Project / University	144	1,355,232	8,498	2 (e)	449.4	2,562,963	12,976
E054	4909119	NC0057936	VFD, EE Blowers, DO Control, Motors - WWTP	144.4	1,360,163		2 (e)	1.7	476,525	
E055	4612027	TAA0006515	Gas lift to rod beam pumps / Oil Wellfield	142.01	1,317,347		3 (e)	105.2	921,342	
E056	5562130	2K10043908	Downsize Pump / Refinery	142.6	1,249,133		3 (e)	0	0	
E057	5023824	NC0079314	New VSD Air Compressors / Refinery	142.2	1,245,697		3 (e)	(868.9)	(7,611,197)	
E059	5553670	TAA0007536	Variable Speed Drives on Submersible Pumps / Oil Wellfield	115.97	1,001,971		3 (e)	(162.67)	(1,405,505)	
E060	5928993	NC0068713	New Construction / Greenhouse			100,833	5 (g)			92,988
E066	5562100	2K1042120C	Pool Cover / School			82,683	5 (g)			32,141
E079	4765915	2K09020878	Constant to Variable Speed Chiller / Office	62	309,324		4 (e)	55.1	479,441	

Itron RecordID	ED Claim ID	IOU Application Code	Measure / Site Type	Ex-ante kW Savings	Ex-ante kWh Savings	Ex-ante Therm Savings	Stratum	Ex-post First Year kW Savings	Ex-post First Year kWh Savings	Ex-post First Year Therm Savings
E080	4471609	NC0071193	Whole Building Retrofit / Community College	259.4	310,491	(1,192)	4 (e)	35.5	117,335	(1,134)
E081	4588416	2K10035510	CO sensors on Garage fans / Commercial Building	45.4	298,335		4 (e)	19.3	126,730	
E084	4508631	2K08008206	New AHU, Packaged Units, VAV Conversion / Office		236,607		4 (e)		0	
E085	4440942	NC0094413	Whole Building Retrofit / Office Building	83.1	194,512	4,185	4 (e)	77.7	349,533	14,916
E086	4581670	NC0107597	Whole Building Retrofit /University		55,432	18,030	5 (g)	(1)	57,767	27,723
E087	4466871	APC009682	Rehab water pumps/ Municipal Water Agency	25.5	220,366		4 (e)	67.04	482,857	
E089	5045757	TAA0007017	Ozone Laundry Modification / Hotel			22,051	5 (g)			2,687
E091	4657853	NC0046709	Whole Building Retrofit /University	278.3	119,590	8,937	5 (g)	177.4	536,702	40,347
E092	5318601	TAA0007440	Boiler Economizer, Change Boiler Operation / Mftr.			19,590	5 (g)			3,680
E093	4453768	2K10033486	VSDs on Refrig. Evap Fans / Refr. Storage	21.3	186,610		4 (e)	42.8	473,408	
E096	4449630	NC0051818	Whole Building Retrofit /Primary School	98.2	119,124	2,410	5 (g)	16.4	85,894	1,025
E097	4861846	NC0108553	VSDs on Irrigation Pump / Farm	67.9	129,344		5 (e)	58.4	93,441	

Itron RecordID	ED Claim ID	IOU Application Code	Measure / Site Type	Ex-ante kW Savings	Ex-ante kWh Savings	Ex-ante Therm Savings	Stratum	Ex-post First Year kW Savings	Ex-post First Year kWh Savings	Ex-post First Year Therm Savings
E098	4282665	2K10030471	EE Boiler and VFD / Office bldg		38,564	7,728	5 (g)		34,539	5,173
E103	4522064	NC0049673	Whole Building Retrofit / Community College	42.1	52,617	2,078	5 (g)	4.8	20,933	726
E105	5134189	TAA0007082	New Steam Condensate Heat Exchanger - Food Processing			3,480	5 (g)			3,054
E106	4969029	2K09022364	Controls on Hot Water Pump / Office Building	3.6	31,767		5 (e)	3.4	26,827	
E109	4390304	TAA0005887	Refrigeration Measures / Convenience Store	2.39	23,291		5 (e)	0.59	5,485	
E111	4470558	TAA0006139	ECM motors and Controllers / Grocery)	0.871	7,630		5 (e)	0.95	7,843	
E113	5294949	2K10033761	EMS on HVAC / Retail Store	0.54	9,527	179	5 (g)	(0.1)	11,192	937
E118	4347697	2K08011657	EMS on HVAC / Retail Store	1.74	7,497	28	5 (g)	1.69	11,771	(26)
E119	5294953	2K10033761	EMS on HVAC / Retail Store	0.67	4,868	123	5 (g)	0.73	9,681	20
E121	4351735	2K08011653	EMS on HVAC / Retail Store	1.16	4,214	50	5 (g)	0.3	11,388	484
E122	5548894	TAB0007520	Evaporator Fan Motors / Assisted Living		3,567		5 (e)	0.14	1,320	
E123	4384154	2K09028337	Compressed Air Controller / Winery		2,566		5 (e)		0	
E124	4765067	2K10033776	Remote Thermostat System / Commercial bldg.		2,422		5 (e)		6,510	

Itron RecordID	ED Claim ID	IOU Application Code	Measure / Site Type	Ex-ante kW Savings	Ex-ante kWh Savings	Ex-ante Therm Savings	Stratum	Ex-post First Year kW Savings	Ex-post First Year kWh Savings	Ex-post First Year Therm Savings
F004	SCE2010_1120081		VFDs for Boiler Fans / Manufacturer	871.09	7,630,769		1 (e)	227.2	1,990,356	
F006	SCE2010_1138744	19002	New IMM and Blow molder / Plastics Mftr	1404	5,808,802		1 (e)	939	3,594,886	
F007	SCE2010_1120112		VFDs, Filters, Pipe Size Increase / Commercial Bldg.	564.31	5,005,471		1 (e)	239.4	2,047,437	
F008	SCE2011_1059641		New Large Pumps / Oil Wellfields	594.5	4,546,568		1 (e)	134.2	1,161,812	
F018	SCE2011_1456772		Compr. Air Modifications / Mftr.	412.89	3,013,722		2 (e)	342.9	2,411,521	
F019	SCE2010_1120132		New Fan Wheel - Large 2500 hp Application / Cement Mftr	375	3,011,250		2 (e)	399.3	2,017,672	
F022	SCE2010_1120277		Compr. Air Modifications / Mftr.	309	2,449,621		2 (e)	50.4	399,472	
F024	SCE2010_1120307		Compr. Air Modifications / Mftr.	257	2,237,120		2 (e)	60.3	571,149	
F026	SCE2011_1456769		Compr. Air Modifications / Mftr.	208.33	1,794,597		3 (e)	120	1,034,912	
F027	SCE2010_1000569		Retrocommissioning / Hospital	22	1,581,332		3 (e)	96	1,581,332	
F028	SCE2010_1120121		Process Equt., Compressor Modifications / Mftr.	173	1,463,446		3 (e)	0	0	

Itron RecordID	ED Claim ID	IOU Application Code	Measure / Site Type	Ex-ante kW Savings	Ex-ante kWh Savings	Ex-ante Therm Savings	Stratum	Ex-post First Year kW Savings	Ex-post First Year kWh Savings	Ex-post First Year Therm Savings
F036	SCE2010_1007690		HVAC Controls, VFD on AHUs / Light Industrial Mftr.	110	850,631		3 (e)	158	1,260,590	
F042	SCE2011_1061076		Agric. Pump / Farm		529,355		4 (e)	18.3	169,519	
F050	SCE2011_1453324		Compr. Air Modifications / Mftr.	27.5	322,253		4 (e)	27.5	322,253	
F054	SCE2011_1062527	21186	Whole Building Retrofit / School	156	257,388	299	4 (e)	39	154,007	200
F059	SCE2010_1006593		Agric. Pump / Farm	10.7	71,132		5 (e)	18.6	75,736	
F061	SCE2010_1006715		Agric. Pump / Farm	11.4	50,996		5 (e)	0	0	
F063	SCE2010_1007057		Demand control ventilation (DCV) on RTUs / Commercial Bldg. rooftop air handling units	70.7	36,825		5 (e)	43.5	23,658	
F064	SCE2010_1007167		ECM Motors / Supermarket	3.92	34,366		5 (e)	3.13	27,433	
F066	SCE2010_1006691		Agric. Pump / Farm	5.5	22,774		5 (e)	0	22,553	
F069	SCE2011_1454193		Agric. Pump / Farm	1.8	5,016		5 (e)	1.9	5,083	
G001	2010_3611_5000939282_10	5000939282	Reconfigured Heat Exchangers / Refinery			4,790,381	1 (g)			2,095,061
G003	2010_3611_5000849771_10	5000849771	New Reboilers, Reconfigured Heat Exchangers / Refinery			796,840	2 (g)			591,730
G004	2010_3611_5000858938_10	5000858938	EE Juice Evaporator / Beverage Mftr			467,633	3 (g)			99,162
G008	2010_3607_5000915207_20	5000915207	Retrocommissioning / Hospital			145,153	3 (g)			397,390

Itron RecordID	ED Claim ID	IOU Application Code	Measure / Site Type	Ex-ante kW Savings	Ex-ante kWh Savings	Ex-ante Therm Savings	Stratum	Ex-post First Year kW Savings	Ex-post First Year kWh Savings	Ex-post First Year Therm Savings
G009	2010_3611_5000877496_10	5000877496	Combustion controls / Refinery			270,894	3 (g)			233,581
G013	2010_3607_5000864812_10	5000864812	EE Boiler, Insulation, Backwash System, Pool Cover / Institutional			177,939	4 (g)			252
G016	2010_3611_5000837332_10	5000837332	Improved Surface Insulation / Mftr.			116,254	4 (g)			41,210
G017	2010_3611_5000963908_10	5000963908	Ozone Laundry / Textile Mftr.			112,698	4 (g)		24,591	72,509
G021	2010_3602_5000842309_10	5000842309	Heat Exchanger / Food Processor			33,172	4 (g)			(220)
G026	2010_3607_5000842636_20	5000842636	Burner Retrofit / Commercial Building			81,348	4 (g)			37,886
G038	2010_3611_5000935476_10	5000935476	Install Furnace Door Seals / Tank Mftr.			2,647	5 (g)			0
H001	2010_3118_5000866767_30	5000866767	Economizer for Heat Recovery / Laundry			708,450	2 (g)			428,359
H002	2010_3118_5000973772_20	5000973772	Whole Building Retrofit / Refrigerated Warehouse	482	3,025,412		1 (e)	715.4	3,318,002	
H013	2010_3117_4530-1_1	4530-1	CO Sensors on Garage Fans / Institutional Bldg.	107.72	1,084,611		2 (e)	0	0	
H015	2010_3117_4306-1_1	4306-1	MBCx Project (Pump VFDs, Chiller Optimization) / Light Manufacturing	71.2	912,446		2 (e)	49.84	656,961	

Itron RecordID	ED Claim ID	IOU Application Code	Measure / Site Type	Ex-ante kW Savings	Ex-ante kWh Savings	Ex-ante Therm Savings	Stratum	Ex-post First Year kW Savings	Ex-post First Year kWh Savings	Ex-post First Year Therm Savings
H032	2010_3118_5000873965_30	5000873965	Whole Building Retrofit / Large Office		434,001	21	3 (e)		246,451	743
H034	2010_3118_5000889944_20	5000889944	Whole Building Retrofit / Hospital		338,528		4 (e)		286,189	
H042	2010_3117_4551-1_1	4551-1	CO Sensors on Exhaust Fans / Garage	9.8	98,601		5 (e)	6.9	60,147	

Appendix C

Lower Rigor Form and Assessment Metrics

C.1 Appendix – Lower Rigor Assessment Form

Lower Rigor Findings for Custom Impact Evaluation and Program Assessment

Note: This form is for both Lower Rigor projects and M&V projects in the Custom Impact evaluation. Please complete as fully as possible. All sections of this form are to be completed as fully as possible.

Table 1-1: Project Information

	Parameter	Value
1	**IOU**	
2	**Application ID**	
3	**Application Date**	
4	**Program ID**	
5	**Program Name**	
6	**Program Year**	
7	**Itron Project ID**	
8	**IOU Ex Ante Savings Date**	
9	**ED Measure Name**	
10	**Project Description**	
11	**Date of ED Review**	
12	**Primary Reviewer and Firm**	
13	**Review Supervisor and Firm**	
14	**Type of Review (Desk, On-site, Full M&V)**	

	Measure Description	Value
15	**Project description from IOU tracking data:**	
16	**Full Description:**	
	Summary of Review	
17	**In the first paragraph, describe the documents reviewed.**	
18	**In paragraph 2, describe your understanding or lack of understanding of the project based on all of the documents provided.**	
19	**In subsequent paragraphs, describe any discrepancies, missing information, problems or issues observed with project or analysis, including final application energy savings, costs and incentives, and any inconsistencies.**	
	Review Conclusion	
20	**Provide a description of major shortcomings in energy savings methods and adherence to program rules, including specific program eligibility issues or baseline issue. Include recommendations for a standard practice (ISP) baseline study if needed.**	
	Reserved	<leave blank>

Table 1-2: Project Results Review

	Description	IOU Ex Ante Data	ED Assessment / Recommendations
21	**Project Baseline Type (Early Replacement,**		
22	**Project Cost Basis (Full Cost, Incremental Cost)**		
23	**RUL (Early retirement projects only, otherwise N/A (not applicable)**		
24	**EUL**		
25	**First Year kWh Savings**		
26	**First Year Peak kW Savings**		
27	**First Year Therms Savings**		
28	**kWh Savings (RUL Period)**		
29	**Peak kW Savings (RUL Period)**		
30	**Therms Impact (RUL Period)**		
31	**kWh Savings (EUL – RUL Period)**		
32	**Peak kW Savings (EUL – RUL Period)**		
33	**Therms Savings (EUL – RUL Period)**		
34	**Annual Non-IOU Fuel Impact (RUL Period)**		
35	**Annual Non-IOU Fuel Impact (EUL – RUL Period)**		
36	**Net-to-Gross Ratio**		

Table 1-3: Detailed Review Findings

	Reviewed Parameter	Analysis
37	**Project Gross Savings Baseline (**for early retirement projects only, include RUL through EUL baseline)	IOU Proposal: ED Assessment: ED Recommendation:
38	**Project Cost Basis (**for early retirement projects only, include RUL through EUL cost basis treatment)	IOU Proposal: ED Assessment: ED Recommendation:
39	**RUL** (required for early retirement projects only, otherwise n/a)	IOU Proposal: ED Assessment: ED recommendation:
40	**EUL**	IOU Proposal: ED Assessment: ED Recommendation:
41	**Input Assumptions for Savings Determination**	IOU Proposal: ED Assessment: ED Recommendation:
42	**Calculation Methods/Tool review**	IOU Proposal: ED Assessment: ED Recommendation:
43	**Pre- or Post-Installation M&V Plan and Results**	IOU Proposal: ED Assessment: ED Recommendation:
44	**Net-to-Gross Review**	IOU Proposal: ED Assessment: ED Recommendation:

Table 1-4: Lower Rigor (LR) Review for Program Assessment

	Parameter	Value
45	**Site Number:**	
46	**Program Number:**	
47	**DEER (or other) Building Type:**	
48	**Reviewing Firm:**	
49	**Reviewer:**	
50	**Indicate if assessment is based upon:**	
	Pre-SSMVP/EAR:	
	LR File Review:	
	LR Interview:	
	Site Visit:	
	M&V Initial:	
	M&V Final:	

Table 1-4: Lower Rigor (LR) Review for Program Assessment

	Program Assessment Factor	Able to Assess (Y/N)	Required by Program (Y/N)	Provided for Project (Y/N) or Quality (Good, Fair, Poor)	Should be Required / Provided in Future	Notes
51	**Ex-ante Conditions Vary from As-Found Conditions**		N/A	N/A	N/A	
52	**Measures are IOU Program Eligible**		Y		Y	
53	**Measures Exceed Code or Industry Standard Practice**		Y		Y	
54	**Appropriate Baseline (if no, complete below)**		Y		Y	
	If no, specify which of these causes apply:					
55	***1. Inappropriate or ineligible early retirement claim***					
56	***2. Title 24 or other applicable code or standard not applied or inaccurately applied***					
57	***3. Standard practice for non-code measures not considered***					
58	***4. Other (describe briefly in Notes)***					
59	**Customer Installation Meets All Program Rules (if no, complete below)**		Y		Y	
	If no, specify which of these causes apply and describe in notes section:					
60	***1. Equipment remaining life differs from program rules***					
61	***2. Equipment repair disallowed***					
62	***3. O&M / operational practice changes disallowed***					
63	***4. Measure not permanent***					
64	***5. Measure life less than five years for non-RCx measure***					
65	***6. Lower than required efficiency***					
66	***7. Existing equipment not removed as required (note if retained as standby)***					
67	***8. Ineligible fuel switching***					
68	***9. Other (describe briefly in Notes)***					
69	**Early Replacement Claim: Valid RUL / EUL Approach Used**		N		N	
70	**Appropriate Impact Calculation Method (if no, complete below)**	Yes	Y	Good	Y	
	If no, specify which of these causes apply:					
71	***1. Inappropriate use of regression***					
72	***2. Inappropriate use of bin method***					
73	***3. Inappropriate use of modeling tool***					
74	***4. Modeling tool provided inaccurate estimates***					
75	***5. Spreadsheet is functionally and/ or structurally inaccurate***					
76	***6. Other (describe briefly)***					
77	***Project calculations done by:***	IOU Consultant				
78	**All Relevant Inputs Considered**	Yes	Y	Yes	Y	
79	**Adequate Values for All Inputs**	Yes	Y	Fair	Y	
80	**Appropriate HVAC Interactive Effects Calculation Method**	N/A	Y	NA	NA	
81	**Appropriate non-HVAC Interactive Effects Calculation Method**	No	Y	Missing	Y	
82	**Multiple IOU Fuel Impacts Properly Accounted for (includes Fuel Switching and Cogeneration)**	No	Y		Y	
83	**If Applicable, Fuel Switching Supported with Three Prong Test**	N/A	NA	NA	N/A	
84	**Non-IOU Fuel and Ancillary Impacts of Project Properly Accounted for (Cogen/Waste Heat Recovery/ Refinery Gas, etc.)**	No	N	No	Y	
85	**IOU Tracking Data Complete and Accurate**	Yes	Y	Poor	Y	
86	**IOU Application Documentation Complete and Accurate [3]**	Yes	Y	Good	Y	
87	**Project utilized pre-installation M&V**	Yes		Good		
88	**Project utilized post-installation M&V**	Yes		Good		

C.2 Implementation Assessment Criteria

While performing the desk review, the lead evaluation engineer is responsible for filling out the Lower Rigor Assessment form with the results of the review. This section describes the metrics and criteria used to assess the implementation accomplishments and shortcomings for each sample. For this report, these criteria are organized into three broad categories including:

- Appropriate Measure and Baseline Specifications,
- Appropriate Calculation Method, and
- Compliance with Program Rules.

These groups are a different organization and sequence of the criteria as presented on the form in order to facilitate a discussion of similar topics.

C.2.1 Lower Rigor Assessment – Meaning of Columns

The Lower Rigor Assessment form is organized as a table with a row for each assessment metric and a column for each of the four dimensions of the assessment, as discussed in this section. A pre-formatted Microsoft Excel workbook was provided to the evaluation engineer which limited the allowable answers for each question to improve quality control and to allow a rapid roll-up of the responses for analysis.

Able to Assess (Y/N)

For each of the criteria the first question the evaluator addresses is whether or not the criterion can be assessed. A criterion is assigned "yes" if there is sufficient documentation to provide an assessment and for each metric, otherwise "no."

For many of the metrics, a "no" to this question is itself an assessment of a shortcoming in the sample project. However, during the scoring and analysis of the results of the program implementation assessment, only responses that are "able to be assessed" are included in the final tally. This criterion has a special meaning and interpretation for metrics where the metric is not applicable to the sample project, i.e., the early replacement metric is not applicable to new construction projects. A "no" answer to this dimension is responsible for some of the program domains having insufficient points to provide a significant result in the analysis.

Required by Program (Y/N)

For each of the criteria the second question the evaluator addresses is whether or not this particular metric is applicable to and required by the program under which the sample project is implemented. The answer is "yes" for most metrics because they were selected based upon their

wide applicability as part of the CPUC requirements for all programs. However, where there are differences between programs the evaluator can specify a "no." During the scoring and analysis of the results, only responses that are "required by the program" are included in the final tally.

Provided for Project (Y/N) or Quality (Good, Fair, Poor)

The third question and the one with the greatest explanatory power for the program implementation assessment is the evaluator's response to the third question. Here the lead engineer addresses whether or not sufficient and accurate information is provide for each metric. If only a binary response is appropriate, the valid responses are Yes, or No, and if a quality response can be provided, then the responses are "Good, Fair, or Poor."

Should be Required / Provided in Future (Y/N)

For each of the criteria, the fourth question the evaluator addresses is whether or not this particular metric should be applicable to and/or required by the program given the site-specific conditions found at each sample project.

C.2.2 Lower Rigor Assessment – Meaning of Responses to "Provided for Project"

The rows of the Lower Rigor Assessment form are populated with individual metrics for which the evaluator provides an assessment of each of the different columns. For the sake of brevity, this section discusses the range of possible meanings for all of the metrics.

> **Good or Yes –** A project is assessed as "yes" only if all of the qualities which distinguish this metric are true for this specific project. For example, if the documents provided are all available in a "live," unlocked, electronic format, and if the documentation addressed all measures and all claimed savings, then answer would be "good." Similarly for each of the other metric, the "Yes" or "Good" response means that the lead evaluation engineer judged the documentation of this metric to be above average.
>
> **DEER Method** – This is the "good" response for some of the metrics which have a specific calculation approach prescribed by CPUC guidelines or program rules. This answer is given, for example if "interactive effects" between multiple measures installed at a site are calculated according to a CPUC approved method. This includes projects analyzed with eQuest or other DOE-2 based simulation software.
>
> **Fair –** A project is assessed "fair" if only some of the criteria associated with a complete understanding of the metric are true. For example, if the calculations are provided in a "live," unlocked Excel file format, but some of the measures and/or claimed savings is

missing documentation, then the response would be judged as "fair." This response characterizes the sample point as "average" on this metric.

Poor or No – A project is assessed "poor" if most of the criteria associated with a complete understanding of the metric are not true or absent. For example, if the requested documents are not provided in a searchable electronic format or if more than one of the measures and/or claimed savings is missing documentation, then the response would be judged as "poor." A project is assessed "no" if no documentation is provided, if absolutely no understanding of the metric is possible, or if the information provided was incorrect or implausible.

Missing – A metric is assessed "missing" if there no documentation of HVAC interactive effects, and a few other metrics, is provided.

Blank or "N/A" – A blank response or "N/A" means that this metric is not applicable to this project. This response plays an important role as it relates to the early replacement metric. A blank response in this case means that "Early Replacement" is not applicable to this type of project, i.e., a new construction project.

C.3 Lower Rigor Assessment Detailed Criteria

C.3.2 Criteria for "Appropriate Measure and Baseline Specification"

This group of criteria addresses the issues related to the adequacy of documentation provided to clearly define the installed measures and the applicable baseline for the project.

Ex-ante Conditions Vary from As-Found Conditions – Criteria

This assessment metric was not addressed during the desk review process as no on-site verification activities were conducted for the Lower Rigor sample. This criterion was a placeholder for subsequent results to be recorded after the on-site verification activities.

IOU Application Documentation Complete and Accurate – Criteria

This assessment metric addresses whether or not the documentation provided by the IOU for each sample point includes all of the requested documents. In the absence of one or more particular document extraordinary effort is used to gather the information from other documents. A follow-up data request is time consuming, and for the Lower Rigor points, is conducted only when nothing about the project was provided. On the other hand, M&V points were subject to multiple data requests as needed to obtain utility billing data and other documentation not provided initially. The initial documentation request for each project requested all documents in electronic format because electronic documents are "searchable" and allow the evaluator to

identify specific pieces of information with the minimum effort and to manipulate that information as needed to re-calculate the ex ante results. Only the original, unlocked, electronic Excel document, for example, contains the formulas in each cell that are used to sum the hours of use for a measure, calculate the average amperage across a range of point measurements, etc.

> **Good or Yes** – A project is assessed as "yes" only if all of the documents are available in a "live," unlocked, electronic format and is assessed as "good" if the documentation addressed all measures and all claimed savings.
>
> **Fair** – A project is assessed "fair" if only the calculations are provided in a "live," unlocked Excel file format, or if one of the measures and/or claimed savings is missing documentation.
>
> **Poor or No** – A project is assessed "poor" if none of the documents are provided in a searchable electronic format or if more than one of the measures and/or claimed savings is missing documentation. A project is assessed "no" if no documentation is provided. Essentially this is not allowed to happen according to our evaluation protocols.

A scanned PDF of a paper document usually does not qualify as a "searchable" electronic document unless sophisticated software with "optical character recognition" capabilities is used to scan the document, and even in this case, such documents typically are not formatted for easy cut-and-paste between the PDF and another program and usually contain typographical errors. These limitations make scanned PDF documents unsuitable for use in evaluations unless absolutely no other form of the document is available.

IOU Tracking Data Complete and Accurate – Criteria

The lead evaluator for the project reviews all rows of the IOU tracking database associated with the project and compares the values found with the associated values in the project documentation.

> **Good or Yes** – A project is assessed as "good" or "yes" only if all of the tracking records and all of the relevant values are accurate, i.e., the values match the IOUs application form, or preferably, the post-installation verification report, if available.

Fair – A project is assessed "fair" if the records are complete for all measures or the values are accurate for the overall project, but the measure description may be inaccurate or incomplete and there may minor discrepancies are found in some values.

Poor or No – A project is assessed "poor" or "no" if the tracking database does not match the project documentation both in measure type or count and in overall savings claim.

Accurate project tracking information is essential for the evaluation process because it is the source of the "denominator" in the measurement and evaluation process. It also serves to define the scope of the project, provide contact information, and identify the assumed effective useful life of the measure. If any of these are not provided, significant extra effort and delays are introduced into the evaluation process for follow-up data requests, phone calls, and unnecessary calculations. A detailed review of the shortcomings in the tracking database design is the subject of other reports.

Project utilized pre-installation M&V – Criteria

The "project utilized pre-installation M&V" metric assesses the degree and accuracy of the IOU's efforts to utilize on-site data collection activities to quantify the project's pre-existing conditions. An accurate assessment of the pre-existing conditions allows the implementer and evaluator to determine the baseline type and baseline equipment efficiency, and/or to rule out the pre-existing conditions as more efficient than codes and/or industry standard practice.

Good or Yes – A project is assessed as "good" or "yes" only if the documentation included a preliminary audit report or carefully described the pre-existing conditions (where applicable).

Fair – A project is assessed "fair" if only a brief one-sentence description of the pre-existing conditions is provided that leaves some question(s) as to the assumed baseline type or baseline equipment efficiency.

Poor or No – A project is assessed "poor" or "no" if no pre-installation inspection report or description of the pre-existing equipment within the scope of the project is included.

Blank – A blank response means that pre-installation is not applicable to this type of project, i.e., a new construction project.

Clearly this metric is not applicable to new construction projects, but "gut rehab" or "replace on burnout" projects must include a pre-installation (or a pre-demolition) inspection and report. The level of effort required for this metric depends upon the size of the project energy savings claim.

In the interest of reducing implementation costs only the largest projects are required to perform pre-installation M&V.

Appropriate Baseline – Criteria

The "appropriate baseline" metric assesses the efforts of the IOU to identify and characterize the baseline type (early retirement, normal replacement, system optimization, add-on measure, or new construction) and baseline efficiency (specifications from the pre-existing equipment, code requirement, or industry standard practice).

> **Yes** – A project is assessed as "yes" if the baseline type and baseline type is accurately identified and documentation is provided on the baseline efficiency.
>
> **No** – A project is assessed "no" if either the baseline type is inaccurate or if there was no documentation provided on the baseline efficiency specifications.

The LRA form supports the appropriate baseline assessment with four additional parameters. If the appropriate baseline is assessed as "no" then the additional metric(s) responsible for the discrepancy is assessed with a "yes" response and an optional "other" field is used along with open-form text to describe the nature of the discrepancy.

1. Inappropriate or ineligible early retirement claim – **Yes or No**
2. Title 24 or other applicable code or standard not applied or inaccurately applied – **Yes or No**
3. Standard practice for non-code measures not considered – **Yes or No**
4. Other (describe briefly in Notes) – **Yes or No**

A "yes" answer to any of these parameters identifies it as the primary source of the discrepancy for the "appropriate baseline" assessment. Free-form comments can further clarify the nature and source of the discrepancy and is used by the lead engineer to identify additional questions to be included during the on-site interview for full M&V sample points.

Early Replacement Claim: Valid RUL / EUL Approach Used – Criteria

New to the PY2010-12 program implementation period is direction from the CPUC to provide documentation to support additional savings associated with early retirement projects. For this metric the lead engineer assumes that project goes forward due to "program influence" because the Net-to-Gross interview has not yet been completed.

Yes – A project is assessed as "yes" if the project uses the pre-existing equipment as the baseline type and this assignment is appropriate.

No – A project is assessed "no" the project claimed an incorrect baseline type.

Blank – A blank response means that early replacement is not applicable to this type of project, i.e., a new construction project.

Generally this criterion is one of the most difficult to assess because very few projects explicitly state the baseline type. In these cases the lead engineer deduces the baseline type assigned by the IOU based upon the related information, i.e., the use of the pre-existing equipment as the baseline, the use of a billing analysis with pre- and post-installation energy usage data, the program and the types of projects which usually participate, or the use of full cost versus incremental costs for calculating any applicable rebate caps.

C.3.2 Criteria for "Appropriate Calculation Method"

This group of criteria addresses the issues related to the adequacy of calculations provided to accurately estimate the energy savings, demand reduction, and related impacts of the installed measures.

Appropriate Impact Calculation Method – Criteria

This metric assesses the efforts of the project sponsor to use an appropriate method to calculate the savings without respect to the selection of baseline efficiency and even if the measure specifications, operating hours, and other inputs were inaccurate.

Good or Yes – A project is assessed as "good" or "yes" only if the method is appropriate for the project and the method is likely to produce reliable results considering all of the relevant site-specific conditions. All of the parameters listed below must be accurate.

Fair – A project is assessed "fair" if some measures for a multi-measure site are not calculated accurately or if there is a minor discrepancy in the calculation method which is not likely to cause a significant error in the savings estimate.

Poor or No – A project is assessed "poor" or "no" if any of the six additional parameters are "yes", i.e., inappropriate or inaccurate.

The LRA form supports the appropriate baseline assessment with six additional parameters. If the appropriate impact calculation method is assessed as "fair," "no" or "poor" then the additional metric(s) responsible for the discrepancy is assessed with a "yes" response and an optional "other" field is used along with open-form text to describe the nature of the discrepancy.

1. Inappropriate use of regression – **Yes or No**
2. Inappropriate use of bin method – **Yes or No**
3. Inappropriate use of modeling tool – **Yes or No**
4. Modeling tool provided inaccurate estimates – **Yes or No**
5. Spreadsheet is functionally and/or structurally inaccurate – **Yes or No**
6. Other (describe briefly in Notes) – **Yes or No** plus optional notes.

A "yes" answer to any of these parameters identifies it as the primary source of the discrepancy for the "appropriate impact calculation method" assessment. Free-form comments can further clarify the nature and source of the discrepancy and is used by the lead engineer to identify additional questions to be included during the on-site interview for full M&V sample points.

Sometimes the calculation method is appropriate for the measure generically, but is not appropriate for customer's specific facility, the unique way the measure is installed, or interaction between the measures which change the operating characteristics which require a different calculation approach. For example, a measure whose savings depends upon the flow rate from another device which was subsequently equipped with a VFD will change not only the hours of use, but also the flow rate. A more sophisticated calculation approach which considers both time of use as well as VFD output power is required.

All Relevant Inputs Considered – Criteria

This metric assesses the efforts of the project sponsor to include all of the parameters which affect the savings calculations without respect to the selection of baseline efficiency and even if the incorrect calculation method was used and if the inputs are inaccurate.

Yes – A project is assessed as "yes" only if all of the required inputs are included in the calculations

No – A project is assessed "no" if one or more relevant inputs are missing from the calculations

Sometimes the calculation method is appropriate for the measure generically, but is not appropriate for the customer's facility. This is true of calculation methods which over-simply the calculations for example by assuming the post-implementation hours of use are the same as the pre-implementation hours of use when the measure included controls which change hours of use.

Adequate Values for All Inputs – Criteria

This metric assesses the efforts of the project sponsor to provide accurate input values for all parameters which affect the savings calculations without respect to the selection of baseline efficiency and even if the incorrect calculation method was used or if the calculation approach does not consider all relevant inputs.

Good or Yes – A project is assessed as "good" or "yes" only if all inputs are accurate and there is documentation to support input values which are not typical

Fair – A project is assessed "fair" if most of the inputs are accurate and there is documentation to support most of the input values which are not typical.

Poor or No – A project is assessed "poor" or "no" if most of the inputs are inaccurate or if there is no documentation of the atypical input values.

This metric captures situations in which the inputs provided are taken from pre-approved calculation methods without respect to the site-specific conditions that affect measure impacts. Sometime a CPUC-approved calculation tool contains embedded assumptions of hours-of-use to match the DEER-approved values, but these are not appropriate for the specific facility.

Appropriate HVAC Interactive Effects Calculation Method – Criteria

This metric assesses the efforts of the project sponsor to provide a calculation method and relevant inputs which consider how the measure interacts with the HVAC system that causes an overall increase or decrease in energy use.

DEER Method – This is the "good" response and is assessed if interactive effects are calculated according to a CPUC approved method. This included projects analyzed with eQuest or other DOE-2 based simulation software.

Missing – A project is assessed "missing" if there was no documentation of HVAC interactive effects provided

Poor– A project is assessed "poor" if the method to calculate Non-HVAC interactive effects was inaccurate or if it used a method not approved by the CPUC.

NA – A project is assessed "NA" or blank if HVAC interactive effects are irrelevant to the nature of the project or measures installed.

This metric captures situations in which the calculation approach ignores interactive effects all together or applies a pre-approved interactive effect that contains embedded assumptions of the

HVAC equipment efficiency that are not appropriate for the specific facility. This metric may apply in industrial processes where usually the room containing the measure is unconditioned, but the site-specific conditions indicate otherwise.

Appropriate non-HVAC Interactive Effects Calculation Method – Criteria

This metric assesses the efforts of the project sponsor to provide a calculation method and relevant inputs which consider how the measure interacts with energy-using systems other than the heating and cooling system at the facility that causes an overall increase or decrease in energy use.

DEER Method – This is the "good" response and is assessed if interactive effects are calculated according to a CPUC approved method. This included projects analyzed with eQuest or other DOE-2 based simulation software.

Missing – A project is assessed "missing" if there was no documentation of Non-HVAC interactive effects provided

Poor– A project is assessed "poor" if the method to calculate Non-HVAC interactive effects was inaccurate or if it used a method not approved by the CPUC.

NA – A project is assessed "NA" or blank if Non-HVAC interactive effects are irrelevant to the nature of the project or measures installed.

This metric captures situations in which the calculation approach ignores obvious interactive effects with non-HVAC equipment. This metric sometimes applies in pumping applications or in cases where the details of the project are very unique to the specific activities taking place at the facility. For example, a measure which improves the efficiency of a motor driving a pump circulating a refrigerated liquid would then cause a reduction in energy use by the refrigeration system due to a reduction of heat transferred by the pump into the fluid.

Project utilized post-installation M&V – Criteria

The "project utilized post-installation M&V" metric assesses the degree and accuracy of the IOU's efforts to utilize on-site data collection activities to verify the installation of the equipment and to quantify the project's conditions based upon post-installation operating conditions. An accurate assessment of the post-installation conditions allows the implementer and evaluator to update the calculations with equipment efficiency of the equipment actually installed, and disqualify savings for measures which were not installed and correct for changes in operating conditions that were not foreseen during the initial project application process.

Good or Yes – A project is assessed as "good" or "yes" if the project is verified with an on-site visit after installation and if the post-installation conditions are used to update the savings calculations. If the nature of the project requires long-term monitoring, then a "good" or "yes" assessment indicates that the documentation suggests that such monitoring was conducted.

Fair – A project is assessed "fair" if the project is verified with an on-site visit but the post-installation conditions are not used to update the savings calculations. This may apply to projects where long-term monitoring is not required.

Poor or No – A project is assessed "poor" or "no" if the project is not verified with post-installation verification activities when such activities are required by the program rules or when long-term monitoring was not conducted when the nature of the project suggests that long-term monitoring is required to obtain a reliable estimate of savings.

The level of effort required for this metric depends upon the size of the project energy savings claim. In the interest of reducing implementation costs only the largest projects are required to perform pre-installation M&V. Where the lead engineer finds that post-installation M&V would significantly improve savings estimates then the "Should be Required by Program" is indicated with a "Yes" response.

C.3.3 Criteria for "Compliance with Program Rules"

This group of criteria addresses the issues related to the adequacy of documentation provided to clearly rule out any conditions which would disqualify the sample project because of CPUC guidelines and specific program rules. This effort is assisted by referring to a spreadsheet containing all of the program rules for each program domain whose development is discussed above.

Measures are IOU Program Eligible – Criteria

This metric assesses if the installed measures meet all program rules CPUC guidelines.

Yes – A project is assessed as "yes" only if all installed measures meet program rules.

No – A project is assessed "no" if any of the installed measures do not meet program rules.

This is a fairly straightforward assessment whose accurate response depends mostly upon the evaluator's review and access to the most up-to-date program manuals.

There is some overlap between this metric and the "measures exceed code or industry standard practice" metric below because the application paperwork clearly states that the applicant agrees to install above-standard equipment. For this assessment, the baseline requirement was treated separately from the other qualification criteria for the measure.

There is also some overlap between this metric and the "customer installation meets all program rules" metric. The metric deals only with issues related to the measures while the latter addresses additional site-specific factors not necessarily about the measure eligibility itself.

Measures Exceed Code or Industry Standard Practice – Criteria

This metric assesses if the installed measures exceed the minimum performance requirements for the measure as determined by state and local laws. In the absence of a relevant minimum code requirement, this metric assess if the installed measure exceeds industry standard practices.

> **Yes** – A project is assessed as "yes" only if all measures exceed the applicable baseline
>
> **No** – A project is assessed "no" if any of the measures do not exceed the applicable baseline.

Sometimes the facility is so unique that there are no comparable entities with which to compare the measure. In these cases, the facility's best practices determine the "industry standard practice" for the measure. For example, if a large processing plant for a unique market segment has a policy to install only premium efficiency motors, then a premium efficiency motor is the baseline efficiency specification. Any motor which claims energy savings much exceed the applicable premium efficiency motor baseline in order to be credited with valid energy savings.

Multiple IOU Fuel Impacts Properly Accounted for (includes Fuel Switching and Cogeneration) – Criteria

Energy savings due to CPUC sponsored projects are only those associated with energy obtained from the investor-owned utility companies. This metric assesses the IOU's efforts to characterize impacts associated with fuels purchased from another investor-owned utility, from energy transported by the customer from another facility, or from energy purchased from a non-IOU supplier.

> **DEER Method** – This is the "good" response and is assessed if multiple fuel impacts are documented according to a CPUC approved method and accounted for in the savings calculation approach.

Missing – A project is assessed "missing" if there was no documentation of multiple-fuel impacts provided. This assessment would apply to projects where non-IOU fuel impacts are known to be relevant to the customer's facility.

Poor– A project is assessed "poor" if the method to document multiple fuel impacts was a not an approved method or if inaccurate data or calculation method is used.

NA – A project is assessed "NA" or blank if multiple fuel impacts are irrelevant to the nature of the project or measures installed.

This metric is applicable to public facilities and other well-known cases where multiple non-IOU fuels are known to be an issue. Even if the project involves a small amount of energy consumption as compared to the facility's overall energy consumption these details are not always available to the evaluator. This information is required and should be included in the documentation.

If Applicable, Fuel Switching Supported with Three Prong Test – Criteria

The CPUC generally does not allow rebates to be paid for fuel-switching projects. This metric assesses the IOU's efforts to characterize the impact of projects which may have a fuel switching component.

DEER Method – This is the "good" response and is assessed if fuel switching impacts effects are documented according to a CPUC approved method, and accounted for in the savings calculation approach.

Missing – A project is assessed "missing" if there was no documentation of fuel switching impacts provided. This assessment applies to a project where the documents supporting a "Three-prong Test" are not provided.

Poor– A project is assessed "poor" if the method to document fuel switching and/or cogeneration impacts are a not an approved method or specifically approved by the CPUC when required, or if the methods used inaccurate data inputs.

NA – A project is assessed "NA" or blank if fuel switching and/or cogeneration impacts are irrelevant to the nature of the project or measures installed.

A failure to account for fuel switching can have a significant impact on program savings if the load associated with the measure is transferred from a non-IOU fuel source to an IOU fuel source. Any energy savings claimed are invalid since they involve non-IOU fuel and the additional energy now consumed from the IOU source is considered "load building" and counts

as negative energy savings for the project. This can be avoided by accurately characterizing such projects as new construction associated with the new fuel source of the measure.

Non-IOU Fuel and Ancillary Impacts of Project Properly Accounted for (Cogen/Waste Heat Recovery/ Refinery Gas, etc.) – Criteria

Energy savings due to CPUC sponsored projects are only those associated with energy obtained from the investor-owned utility companies. This metric assesses the IOU's efforts to characterize impacts associated with energy from on-site cogeneration facilities.

> **Yes** – A project is assessed "yes" if cogeneration impacts are documented and accounted for in the savings calculation approach.
>
> **No** – A project is assessed "no" if cogeneration impacts are not documented or missing from the calculations.
>
> **NA –** A project is assessed "NA" if there is likely to be no cogeneration issues.

This metric is applicable to public facilities and other well-known cases where cogeneration is known to be present. Even if the project involves a small amount of energy consumption as compared to the facility's overall energy consumption and/or cogeneration assets, these details are not always available to the evaluator. This information is required and should be included in the documentation.

Customer Installation Meets All Program Rules – Criteria

The metric assesses the project's documented compliance with overall program rules as implemented at the specific facility.

> **Yes** – A project is assessed as "yes" only if all of the parameters listed below are adequately addressed in the documentation.
>
> **No** – A project is assessed "no" if one or more of the parameters listed below are not adequately addressed in the documentation.

The LRA form supports the assessment of this metric with eight additional parameters. If any of the parameters are not adequately addressed, then the answer is assessed "no" and a description of the discrepancy is provided in the notes column. The parameters listed below are straightforward and require no additional explanation:

1. Equipment remaining life differs from program rules – **Yes or No**
2. Equipment repair disallowed – **Yes or No**

3. O&M / operational practice changes disallowed – **Yes or No**
4. Measure not permanent – **Yes or No**
5. Lower than required efficiency – **Yes or No**
6. Existing equipment not removed as required (note if retained as standby) – **Yes or No**
7. Ineligible fuel switching – **Yes or No**
8. Other (describe briefly in Notes) – **Yes or No** plus notes.

A "yes" answer to any of these parameters identifies it as the primary source of the discrepancy for the "customer installation meets all program rules" assessment. Free-form comments can further clarify the nature and source of the discrepancy and is used by the lead engineer to identify additional questions to be included during the on-site interview for full M&V sample points.

Appendix D

LRA Case Studies, Findings, and Reviewer Comments

D.1 Assessment Case Reviews

This section presents several case reviews that are compiled from the Lower Rigor Assessment results. These case reviews are selected for their ability to highlight specific issues and to illustrate the usefulness of the desk review process as compared to the more rigorous M&V process.

D.1.1 Case Review of Sample Point E053

E053 – PGE21262 – University Of California / California State University. This monitoring-based commissioning project (MBRCx) takes place at an educational building containing research laboratories, an electronic micro fabrication facility, classrooms, and offices which are occupied and operated 24/7. The measures include consolidating many small cooling sources into one system and various other air-side and water-side optimizations. The building is supplied with steam from a central plant, chilled water from the adjacent building, and is equipped with dedicated electric and steam meters.

Documentation: The IOU documents include application form, e-mail correspondences, budget proposal and incentive, findings report (not legible), and EMS screenshots (not legible). The documentation provides a very limited description of the measures implemented and there appears to be a discrepancy between the numbers of measures installed versus claimed. The documentation **does not** include the following data which usually accompany an MBRCx project: detailed project scope, deficiencies observed during the MBRCx, pre-function and functional test reports, energy savings calculation, a legible MBRCx findings report, trend analysis report, list of control points monitored, and the raw data for the control points. The project documentation is not adequate to conclusively review the project.

Accomplishments: The IOU tracking data is complete and accurate. It appears that the savings estimate appropriately includes additional gas savings to account for the loss of steam condensate which are estimated with a calculated approach using the heat needed for the makeup water to be heated from 55 F to 150 F. The measures appear to be program eligible and to exceed code and/or industry standard practice and meet all program rules.

Shortcomings: The information available from the project file is very limited. Additional baseline and scope information is required.

Preliminary M&V Results: kW: 311%; kWh: 189%. ***Savings for this project are under review and may vary substantially.*** An attempt to quantify savings based upon a billing analysis was unsuccessful. The savings analysis is in the process of being re-done using a retrofit isolation approach. The savings discrepancy is primarily a result of increased electric load due to a fire in the building. For this project, the lower rigor process is successful at identifying a project with major documentation lapses which may have contributed to significantly under-reported savings.

D.1.2 Case Review of Sample Point E057

E057 – PGE21021 – Industrial Calculated Incentives. The customer installed two new 1,500 HP electric motor-driven, VFD-controlled natural gas compressors at a natural gas field.

Documentation: IOU application documents include an energy savings report prepared by the IOU's consultant and a calculation summary prepared by the IOU's reviewer. There is reference to a post installation report; however, it is not included in the documents received after multiple data requests. The IOU documents provide a good description of the project; however, the savings method is not explained in depth. A three-prong test is not provided.

Accomplishments: The project baseline type appears appropriate as new construction with an expected useful life of 15 years. The measures appear to be eligible under program guidelines and the customer installation appears to meet all program rules.

Shortcomings: It is unclear if a post-installation inspection is performed; however, the impacts are reduced by approximately 35% by the IOU project reviewer without explanation. Multiple IOU fuel impacts, non-IOU fuel, and ancillary impacts of the project are not properly accounted for and these issues are relevant because this type of facility is likely to have cogeneration and this type of customer is likely to have direct access rights to the natural gas pipeline for transporting fuel between sites.

Preliminary M&V Results: kW: -611%; kWh: -611%. The ex-ante calculation assumes a baseline of an uncontrolled electric compressor with savings attributed to a more efficient electric compressor; however, a pre-existing gas powered engine-driven compressor fueled by non-IOU gas is actually in place. The load on the IOU electric grid is increased by this project. While all of this data was available during the desk review, it was not until the on-site visit that it was discovered that the pre-existing natural gas-powered compressors were still in working order and that this project is more appropriately characterized as an early retirement scenario with the in-situ natural gas fired equipment as the baseline.

D.1.3 Case Review of Sample Point E059

E059 – PGE2222 – Energy Efficiency Services for Oil and Gas Production. The project involves installing VFDs on electric submersible pumps (ESP) to pump water for oil extraction and other processes. They are operated 24/7 until degradation indicates the need for repair.

Documentation: The documentation includes billing data, project application, post-installation inspection report and supporting documents, energy savings calculation spreadsheet (PDF) and project invoices. Trend data is not provided and is needed to verify pre and post installation run hours, kW and kWh usage. (Note: The evaluation team's M&V plan calls for determining the operating hours during an on-site visit.)

Accomplishments: The applicant appears to have applied appropriate baselines and energy savings algorithms to arrive at ex-ante savings values. The baseline type for VFD installations is "add-on measure" and is appropriate for installations on existing pumps not so equipped. The appropriate calculation methods are used and appear to consider all relevant inputs. The measures and the overall project appear to be eligible as per program rules and the measures exceed industry standard practice, but ISP will be investigated during the site visit.

Shortcomings: The IOU tracking data is incomplete because it does not contain specific measure or project descriptions and no facility contact information. The project may not be in compliance with program rules because non-IOU fuel and ancillary impacts of the project are not accounted for in the documentation. Non-IOU fuels may be involved in providing some of the energy for this facility either directly or through cogeneration and improved production and better management may result in less sanding in wells, thereby increasing the measure life and long-term maintenance costs.

Preliminary M&V Results: kW: -71%; kWh: -71%. The ex-ante calculation assumed a baseline of an uncontrolled electric pump with savings attributed to a VFD on that pump; however; a pre-existing engine-driven pump fueled by non-IOU waste gas was actually the pre-existing equipment and is the appropriate baseline equipment. The existing pump is less expensive to maintain than a new electric pump and is less efficient on an equal BTU basis. Load on the IOU electric grid was increased by this measure. In this case, the desk review identified possible issues with non-IOU fuels that were conformed with on-site verification activities.

D.1.4 Case Review of Sample Point E123

E123 – PGE21031 – Ag Calculated Incentives. The project involves the installation of an intermediate flow controller on a compressed air system at a beverage processor. A flow controller was installed that would allow pressure to be decreased saving electrical energy. The baseline was the existing system (this appeared to be the correct baseline).

Documentation: All application documentation provided by the IOU was reviewed. The project documentation is adequate.

Accomplishments: The project description was complete and understandable. The calculation method was considered appropriate. Pre and post inspection by the IOU was performed. The baseline appeared correct.

Shortcomings: Improper input values for the calculation were used. The pre inspection identified the baseline pressure to be 106 psig. After the measure was installed, the high side pressure was increased to 120 psig and the low side pressure was set to 100 psig. The IOU incorrectly specified 120 psi for the baseline pressure used in the ex-ante savings calculations.

Preliminary M&V results: kWh: 0%. The site visit revealed that the low side pressure actually increased from 106 psi to 108 psi. The measure was unsuccessful in savings energy and zero savings were credited to this project. The desk review process can be successful in uncovering errors in the input values; in this case, the error would decrease ex-ante savings. However, the M&V site visit revealed that the pressure was not reduced as expected, and zero savings were credited to this measure. As evidenced by this project, the desk review process cannot always capture the most current operating conditions.

D.1.5 Case Review of Sample Point F004

Site F004 – SCE-SW-003B – Industrial Energy Efficiency Program. The facility produces combustible gasses. The customer installed new VFD controls on the furnace combustion induced draft and forced draft fans to reduce fan energy and more efficiently control combustion.

Documentation: Customer incentive application, calculated measures (SPC), installation report, customer correspondence, invoices, project application review, application review comments, pre-installation inspection report, installation report review, installation report review comments, post-installation inspection report, customer provided savings, and charts. The project file provides a clear understanding of the installed project and the source of energy savings and no discrepancies are noted in the energy savings, project costs, or incentives paid to customer.

Accomplishments: Electrical savings are based on one month of post-installation and five months of pre-installation SCADA data. A curve fit is obtained for the fan kW as a function of 26 months of pre-installation production data. The baseline appears to be appropriately determined as the operational schedule and efficiency of the pre-existing fans using the pre-existing control equipment, e.g., dampers and blowout holes. The customer initially used fan curves to characterize the post-installation performance, but subsequently used metering of both baseline and post-installation fan power and flow to revise calculations. The level of IOU metering and M&V is appropriately rigorous for a project of this size of impact and uncertainty.

Measures are IOU program eligible. Measures exceed code or industry standard practice. Multiple IOU fuel impacts are properly accounted for in a separate application to their gas IOU. Customer installation meets all program rules.

Shortcomings: There were no shortcomings evident during the desk review.

Preliminary M&V results: kW: 26%; kWh: 26%. The documentation of the measure matches the on-site verified operational profile, but the ex-ante calculations used different data; the ex-ante calculations are based upon inaccurate production rates. In this case, the desk review process is successful in identifying appropriate data collection and calculation methods, but only on-site verification activities can identify discrepancies between the documentation and the actual operating conditions and rates of production for the facility. The desk review process identified the operating characteristics as the parameter with the greatest uncertainty and queued up this issue for further on-site verification and data collection activities.

D.1.6 Case Review of Sample Point F027

Site F027 – SCE-L-005c – Institutional and Government Core Energy Efficiency. This retro-commissioning (RCx) project includes optimizing AHU temperature control, DDC system upgrade, optimizing AHU schedules, implementing chiller lockout, and optimizing HW pump operation.

Documentation: While the final RCx commissioning report was incomplete, the other project documentation provided a good understanding of the project.

Accomplishments: The project was considered early replacement, but some AHU coil valves repaired/replaced as part of RCx work should be considered normal maintenance. A valid RUL / EUL approach was used, but EUL should be 10 years. eQUEST was used to model four measures and was the appropriate impact calculation method for most measures; all relevant inputs were considered.

Shortcomings: IOU tracking data was not complete and accurate; four electrical measures were not clearly defined. Some of the measures did not have an appropriate calculation method and it is unclear if the measures complied with program rules.

Preliminary M&V Gross Realization Rate: kW: 440%; kWh: 95%. The ex-ante minimum cold deck temperature was 55°F at 70°F outside air temperature, whereas the ex-post minimum average was 52.4°F at 78°F. Overall, more systems were found to have reset schedules programmed than were modeled in the ex-ante simulation. For this project, desk reviews can identify the appropriate use of data from program on-site activities, but due to the changeable nature of buildings, M&V is required to capture the latest operating conditions.

D.1.7 Case Review of Sample Point F059

F059 – SCE-SW-004B – Agricultural Energy Efficiency Program. The project is an agricultural pump system overhaul involving the upgrade of a 150 hp turbine well pump for water pumping at a farm.

Documentation: The IOU documentation includes the customer application, customized solutions agreement, pre-installation hydraulic test report, post-installation hydraulic test report, post installation independent engineers report, well contractor's invoices, incentive payment request, and pump curves obtained from well contractor. The information provided a good understand of the scope of the retrofit; however, the pump curves were not included and would have improved the desk review process.

Accomplishments: The project utilized pre and post-installation M&V with a data collection plan that is acceptable for this pump retrofit. The early retirement baseline type and use of the in-situ pump as the baseline efficiency is acceptable for this pump retrofit where the pre-existing well lining and production requirements are unchanged. The IOU's straightforward spreadsheet calculation is acceptable for pump retrofits when pre- and post-installation data is collected. The data collection activities are acceptable and are required for this project because the customer does not have a flow meter on the well to accurately track power usage against flow rates. The measures are IOU program eligible, exceed industry standard practice and the customer installation meets all program rules.

Shortcomings: It is unclear if the program requires reporting of ancillary benefits, but if so, the project did not properly account for the potential for lower pump maintenance and lower capital improvement cost.

Preliminary M&V Results: kW: 174%; kWh: 106%. Demand s***avings for this project are under review and may vary substantially.*** Additional kWh savings resulted from increased usage of the pump systems. Ex-ante kW reduction was underestimated and inappropriately adjusted downward during the IOU review due to a lower spot reading compared to long-term data. In this case, the desk review is successful in identifying a project that is implemented appropriately, but on-site data collection is still required to identify incorrect adjustments.

D.1.8 Case Review of Sample Point G017

G017 – SCG3611 – #SW-IndA Calculated. The customer is a manufacturer of finished textile products who installed a larger ozone generator to improve efficiency of the laundering process seeking to reduce natural gas consumption associated with water heating and clothes drying.

Documentation: The IOU documentation includes an internal technical review report, project application, billed gas usage, production data, and equipment specifications. The customer collected data on pounds of laundry per therm used before and after the installation of the new ozone system to document savings.

Accomplishments: The IOU application documentation is complete and accurately describes the measure. The relevant inputs to the calculations are considered including hours of use, pounds of laundry, and therms of natural gas used for water heating. The measures are IOU program eligible, exceed industry standard practice and meet all applicable program rules.

Shortcomings: The project appears to suffer from a baseline issue in that the savings claim is based on the entire production of the new unit as an add-on measure instead of the incremental increase in efficiency for the production of the new unit as an early retirement or capacity expansion project. The IOU did not appear to perform pre or post-installation M&V, but this is not unusual because only verification is typically required for projects of this size. Since the project was claimed as an add-on measure, no dual baseline information is provided. This project is listed in the tracking database as 3 separate measures but it is a single project that affects three gas-fired components: water heaters, boilers, and tumble dryers. The IOU claim of a 20 year effective useful life needs to be further explored. Post-installation production records for washers, water heaters, and dryers are needed to normalize for increased capacity.

Preliminary M&V Results: kWh: N/A%; Therms: 64%. ***Savings for this project are under review and may vary substantially.*** There is a smaller efficiency increase than claimed by the IOU. The lower pre-retrofit production level was used as the pre and post-installation production level because the new ozone equipment allowed greater capacity throughput. The load of the pre-retrofit equipment was met by this newly outfitted machine, which had additional capacity for a new process load (stone washing jeans). The pre-retrofit capacity was therefore used as the basis for the savings calculation. No savings were credited for the increased capacity since that capacity is due to a newer process that could only be met by this type of retrofit. Electrical savings were not included in the ex-ante but are a result of the project and are credited in ex-post calculations. In this case, the desk review is successful at identifying significant baseline errors which reduced the allowable savings claim.

D.1.9 Case Review of Sample Point H034

H034 – SDGE3118 – SW NRNC Savings by Design. The project is a new 27,976 sq. ft. three-story medical building involving: high performance glazing; high efficiency T5, T8, and CFL lighting; occupancy sensors; high efficiency package VAV units with VSD fans; heating hot water pumps with premium motors and VFDs; and high efficiency HHW boilers. The building claims to achieve 25.4% reduction in energy consumption as compared to the Title 24 2005 standards.

Documentation: The documentation includes the utility incentive worksheet, post-installation field inspection notes, SBD owner agreement, and specifications of glazing. Significantly, the documentation did not include the electronic EnergyPro model files, invoice and incremental cost breakdown, mechanical schedule, architectural, lighting and mechanical plans, Title 24 report, specifications of AC units, HHW pumps, HHW boiler and lighting fixture.

Accomplishments: The IOU tracking data was complete and accurate. Since the project is new construction permitted in 2008, all measures are appropriately compared with California Title 24 2005 baseline as implemented through the EnergyPro software. EnergyPro inherently addresses interactive effects among affected systems. Savings were estimated with EnergyPro software using whole building approach. All measures are program eligible and appear to exceed code or industry standard practice; however, a final review cannot be completed until the EnergyPro model file is submitted in response to a follow-up data request.

Shortcomings: IOU application documentation is incomplete as discussed above. An assessment of whether all relevant inputs are considered is inconclusive because final Energy Pro modeling files are not provided. It is recommended to perform post-installation M&V and use the data to calibrate the model.

Preliminary M&V Results: kWh: -9%. The ex-post calculations used a verified EnergyPro model to show the building consumes more energy than a baseline code-compliant building because: 1) the verified operating schedule is different than the ex-ante operating schedule, 2) the hot water supply is disconnected from the AHU heating coil, and 3) the ex-ante model was not calibrated. In this case, the desk review identified a new construction project with significant documentation errors, and this correlated with significant errors in the simulation modeling inputs.

D.1.10Case Review of Sample Point H505

Site H505 – SDGE3118 – SW-NRNC Savings by Design. This project consists of two newly constructed buildings totaling 69,860 square feet and incorporates various whole-building energy efficiency measures that reduce the energy consumption 13.9% below the 2005 Title 24 standard for the larger 65,126 square feet building and 28.1% below the 2005 Title 24 baseline for the smaller 4,734 square feet building. The measures include premium efficiency pump motors, VFDs on pump motors, high performance lighting, occupancy sensors, and low-E windows.

Documentation: Project application sheets, utility incentive worksheets, SBD field verification forms, EnergyPro models, Title 24 reports, cut sheet with 1 year of billing data, and equipment cut sheets are included.

Accomplishments: IOU application documentation and IOU tracking data are complete and accurate. Title 24 was used by EnergyPro as the baseline and is the appropriate tool because the software inherently addresses interactivities among affected systems. The project utilizes post-installation M&V by implementing post-installation field verification forms provided by the IOU covering lighting, occupancy sensors, boilers, AC, fenestration, and envelope. A detailed summary of the inspection is provided along with supporting documentation including cut sheets**.** Measures are IOU program eligible and exceed code or industry standard practice. Non-IOU fuel and ancillary impacts of project are properly accounted and do not appear be at issue.

Shortcomings: EUL is claimed to be 15 years for twelve measures and 20 for another measure. The evaluation team consulted 2008 DEER and recommended the following EULs: energy management system at 15 years, high performance windows at 20 years, high efficiency boilers at 20 years, VSD motors at 15 years, occupancy sensor controls at 8 years, premium-efficiency motors at 15 years, and CFL fixtures at 16 years.

M&V Results: None - lower rigor sample.

D.1.11 Case Review of Sample Point E523

Site E523 – PGE2225 – Refinery Energy Efficiency Program. The project involves rerouting piping to eliminate one pump. Energy savings are achieved from reduced pressure loss in the new 24" HDPE line when pumping water from the Pond Sump to the Surge Pond.

Documentation: Original and revised versions of the project application, M&V report, incentive check details, drawings, cost data and pump curves, project correspondence, final M&V report and associated drafts, IOU response to ED data request, calculation spreadsheets, flow rates and billing data. The IOU documents provide a good description of the project and no shortcomings in the documentation are noted. The IOU consultants reviewing the project documented the plan and approach well, and the project and calculation methodology are described in comprehensible detail.

Accomplishments: IOU application documentation and IOU tracking data are complete, and the tracking data savings and costs match the application. The project utilized pre-installation verification and post-installation M&V for savings revisions. The IOU savings utilized pre-installation inspection data and an appropriate baseline. EULs for existing equipment listed in the IOU tracking database appears to be consistent with the CPUC energy policy manual for custom measures. The appropriate impact calculation method is used. IOU reviewers utilized pump curves and actual operational SCADA data for calculations in a spreadsheet based analysis with all relevant inputs considered. The project meets eligibility rules as best able to determine at this point, and measures exceed code or industry standard practice.

Shortcomings: There were no shortcomings evident during the desk review.

M&V Gross Realization Rate: None - lower rigor sample

D.2 Findings by Program Assessment Factor

This section presents the program assessment factor (the evaluation issue or metric) that appear to be the most interesting from the lower rigor assessment process. Where project examples are relevant to the entire program domain, these are also discussed in more detail.

D.2.1 Review of Project Documentation

The quality and quantity of application information continues to be an issue of concern. In many cases more information is needed than is available for a desk review process and the follow on M&V activities. Results would be more conclusive with better documentation and/or after the results of on-site data collection activities.

For one Third Party administered project, the documentation was assigned the wrong project application number by the IOU's internal regulatory affairs staff. The response to the first two data requests resulted in the submission of the same incorrect project information both times. A third request was initiated directly to the Third Party program administrator who facilitated an internal discovery process to unearth the appropriate project documentation.

D.2.2 Review of "Appropriate Calculation Method"

The LRA process identified "all relevant inputs considered" as the evaluation metric with the greatest number of programs showing need for improvement. Determining whether or not all relevant inputs are considered requires a thorough review of the entire project and measures in the context of the specific activities conducted at the facility.

The LRA findings suggests that program implementation staff know that it takes careful attention to ensure that "all relevant inputs [are] considered" and to deliver savings which are reliable and well documented. Successful projects use trending information from the facility's SCADA system when available and refer to as-built drawings, plans, equipment cut sheets and post-installation verification data to true-up their engineering calculations and simulation models. When a whole-building thermal building simulation is involved, the zonal model accounts for an appropriate level of detail, the central plant operations are adjusted to the actual operating parameters for the facility, and the simulation uses CEC weather data for the appropriate CA climate zone to normalize annual energy usage. Baseline characteristics of the simulations and simplified energy models are supported by mechanical and electrical design documents of the pre-existing building or equipment. For simplified estimation approaches, the

equipment efficiency curves for old and new equipment are provided, appropriate affinity law exponents are used, and inputs are updated with on-site verified findings.

LRA findings suggest that "all relevant inputs considered" and "adequate values for all inputs" assessment factors remain an area of concern. Some projects are submitted without essential equipment efficiency rating documentation, e.g., boiler efficiency. Some projects failed to account for fundamental physical principles in the savings calculations such as assuming that the heat loss from a pool surface is reduced to zero when a pool cover is installed. Some projects failed to use available trending information from the facility's SCADA system to verify inputs and to inform operating schedules. The calculations for some projects fail to adjust baselines such as omitting automatic controls that are not present in the pre-existing conditions, but are not allowed to contribute to savings because they are required by code or industry standard practices. Industrial energy efficiency savings depend upon production rates yet some projects failed to account for the ramp-up in production at the beginning of a new project or assumed over-optimistic production rates.

Pre- and post- installation M&V can be enhanced with closer attention by the IOUs and their implementers to the need for on-site data collection to verify operating parameters, providing equipment specifications, and normalizing results to post-installation operating conditions.

D.2.3 Review of "Compliance with Program Rules"

The LRA process identified "measures are IOU program eligible" as the evaluation metric with a low cause for concern. Determining eligibility often requires a detailed review of the latest program manuals to understand new rules introduced late in the program cycle. The list below contains examples of evaluator-provided statements for specific projects illustrating success in this assessment metric. Note that the requirements in these examples do not apply to all programs and projects).

- Verified to be eligible from P&P Manual Rev3.
- Both VFD on pumps and Low-E glazing are eligible.
- Duct static pressure reset is an eligible retrocommissioning measure.
- The payback period of this early replacement project is 3.2 years which makes it eligible as a retrocommissioning project.
- New load type of projects that don't involve new walls or major renovation were added to this program's predecessor program (SPC) in 2009, hence eligible.
- EMS is an add-on measure, hence eligible.

- Server virtualization is an eligible measure.[44]
- Demand control ventilation is an eligible measure.
- Add-on measure hence eligible.

These findings suggest that program implementation staff are generally diligent about reviewing the project application documentation and proposed measures; and have been eliminating measures which violate program eligibility rules.

Some of the LRA findings indicate general approval but provide a cautionary statement:

- Meets rules as best able to determine at this point - need to fully analyze all program rules for this 3P program.
- Application documents state this project is a pilot program, no P&P manual available. Compressed air leak repair subject to further review by ED.
- Verify during M&V process

Conversely, the evaluators also provided statements illustrating the need for improvement as follows:

- Invoices are not clear as to what equipment was installed in order to allow change in boiler sequence of operations.
- Measure description not provided.
- This is routine preventive maintenance.
- Measure fails eligibility because EUL is less than 5 years.

D.3 Other LRA Reviewer Comments

All Relevant Inputs Considered – Reviewer Comments

The evaluators provided statements illustrating accomplishments in this assessment metric as follows:

- 2 Years production data from SCADA, 5 months of baseline metering and 1 month of post metering.
- All building and HVAC system input conditions are considered.
- All inputs are from as-built drawings, plans, equipment cut sheets or on site data collections.

[44] Server virtualization is not an eligible measure in PG&E Territory.

- All inputs related to central plant operation are considered.
- All the relevant inputs were considered in the energy model.
- Applicant used pre-install metered data and an appropriate affinity law exponent in savings calculation.
- Appropriate assumptions were made and SCADA data, as applicable was used.
- Baseline conditions are supported by mechanical and electrical design documents.
- For SPC calculator, all the relevant inputs were considered. Other methodologies may require more.
- Information is available in PA and IR review reports.
- Information is available in pre-installation and post-installation on-site visit, and equipment submittals.
- Information is available in pre-installation and post-installation project reports.
- Input information was collected during the pre-installation and post-installation inspection.
- Inputs properly considered.
- It appears that the input powers are obtained from the pump curves.
- Majority of inputs are from pre-installation and post-installation inspection findings. A few other assumptions are based on the manufacturer's spec sheet. It appears that few inputs require documentation with mechanical schedule and inspection pictures.
- Model broken down by zones and HVAC units; unit efficiencies, equipment efficiencies, and LPD considered in analysis.
- Model had a good level of detail for zones and HVAC units.
- Most of the inputs are available in the savings calculation and supported by the inspection findings.
- Pre verification Title 24 report and Energy Pro model provided.
- Primary inputs include daily kWh usage and OAT, weekly and bi-weekly Therm usage and HDD, extrapolated to annual usage normalized with TMY weather data.
- Product cut-sheets are provided.
- Product specification sheets are provided and the submitted model file is reviewed.
- Product specification sheets were included and cited in savings calculations.
- Pump curve was included.
- SPC 2009 calculator was supplied with all the proper inputs for the baseline and proposed conditions of this project.
- The building model has used the building operating set points.

- The claimed savings calculation is simplified, and has considered all inputs required.
- The DOE-2E model has considered all building and HVAC system inputs.
- The inputs used in calculation of energy savings are metered power consumption and run time hours of the unit.
- Building shell and HVAC specified and showed a good level of detail.

The evaluators provide statements illustrating the need for improvement as follows:

- Actual boiler efficiency not used…no significant change in savings. As per verification site visit, the actual lighting power density not used…greater savings possible.
- Analysis should be normalized to air flow.
- Boiler efficiency is not included in the savings estimation.
- Building specific schedules do not appear to have been included in the analysis. This assessment is based on the supplied version of the simulation model.
- Calculations should be normalized to air flow and/or production.
- Did not account for ramp-up in production rates at the beginning start-up phase of the anaerobic processing system.
- Heat loss from the surface not considered for the installed (w/ pool cover) scenario. The surface is essentially assumed to be adiabatic with a pool cover in place.
- Interval data and/or trending data from post-installation inspection not used to true-up savings, or at least not documented that this was done.
- IOU did not use of EMS/SCADA data to verify inputs/savings.
- It appears that linear feet of anti-sweat heaters not involved in calculation of ASH control savings, and type of cooler/freezer not involved in calculation of either ASH controller or ECM motor and controller savings.
- Load dependence of the measure not account for in the analysis.
- Missing adjustments for pre-existing operational characteristics; assumes an operative control system.
- No spot boiler combustion efficiency tests or economizer performance tests were included in the savings analysis.
- Not all periods considered.
- The analysis applied assumed load factors and static chiller efficiency estimates. These both should have been dynamic variables in the analysis.
- Time-varying nature of peak draw and power factor not considered. Peak loads at beginning of weld to create the arc then diminish and less power is required to maintain the arc; power factor may change depending upon a number of factors.

Appendix E

LRA Data Request and Review Process

This appendix first addresses the request for data that was provided by the evaluators to the IOUs. Secondly, this appendix provides a brief overview of the desk review process that was subsequently completed by evaluators.

E.1 Data Requests

The assessments rely on IOU responses to comprehensive and detailed data requests for program information and project documentation.

E.1.1 Program Information Data Request

A data request was submitted early in the evaluation effort for all of the IOU's program implementation manuals and related documentation as well as contact information for the IOU and Third Party program administrators. Elements of this data request included:

1. Updated contact information for the lead IOU and lead Third Party program implementation administrative personnel for each program.
2. Program Policy and Procedures Manuals (applicable to 2010, 2011 and 2012) along with any supporting implementation process and procedures documents, application forms, hyperlinks to program implementers' websites, standardized savings calculation spreadsheets, DEER references for deemed measures, and work papers for non-DEER measures.
3. A statement that there are no changes between the 2010, 2011, and 2012 programs or indicate with a separate redlined document any updates to the programs implemented for PY2011 as compared to PY2010.
4. A request to annotate or group each file with the "IOUPrgID" value so that each program document can be tied to the specific project/program we are evaluating. If a particular document was shared amongst multiple programs, the IOUs were requested to indicate so.

The results of this data request varied by IOU, but generally we were provided with some program documentation. Contact with SCE, SDG&E and SoCalGas was limited pending resolution of confidentiality concerns. This limitation in access to program staff is a notable

deviation from prior evaluation practices and caused significant delays in completing the evaluation for some projects.

E.1.2 Project Documentation Data Request

The data request for project documentation included the following items, as quoted from the cover letter sent to each IOU.

"For each project listed in the table below please provide all available application data including but not limited to the following information:

1. Final incentive application.
2. Copy of paid invoices.
3. Pre-retrofit energy audit reports, M&V plans, reports, and verification reports.
4. Pre-installation inspection report.
5. Post-installation inspection report.
6. Any evaluation or third party reports or benchmarking study.
7. Raw data archives and logs (such as logger or EMS data) in their original and readable formats.
8. Any spreadsheets or simulation models in their original unlocked formats, i.e. eQuest or EnergyPro input files.
9. Preliminary and final savings calculations and supporting data with documentation to ensure replicability.
10. Manufacturer's cut sheets/specifications when available, indicating their use in estimating ante savings or when needed to ensure replicability.
11. Documentation for any deemed, stipulated or estimated components of ex ante impact calculations of savings, such as hours of use, measure life / effective useful life (EUL), remaining useful life (RUL), and incremental / installed costs (including any analysis or source) and the equation or tool used to determine savings if no live spreadsheet is available.
12. Documentation to support baseline type assignment (code or standard requirement, early retirement, retrofit, replace on burnout, industry standard practice, CPUC policy, etc).
13. Pre-existing system controls and operating schedule and status description.
14. Pre-existing system output capacities – current output and maximum/design capacity.
15. Proposed construction or modifications with drawings, schematics, and equipment specifications, as applicable.

16. Fuel switching considerations and any required analysis per CPUC policy regarding fuel switching or cogeneration projects (see Energy Efficiency Policy Manual).
17. Other fuel savings and/or load increases resulting from the project.
18. Heating, Ventilation, and Air Conditioning (HVAC) interactive effects values and methods used to develop those values, when measures cause a change in HVAC system loads.
19. Interactions between multiple measures or other upgrades that act to increase or decrease savings relative to a measure's savings estimate independent of other measures, or which impact the pre or post monitoring period.
20. For industrial projects, provide pre/post production output data when used in savings calculations and the source of such records.
21. Billing history: one-year pre installation, with interval data when available (with corresponding billing histories required if ex ante estimated values rely upon a per-unit-production changes based on multi-year production data)."

The above project information data request for lower rigor points was submitted separate from the data request for M&V points. However, the M&V points and lower rigor points followed the same data request and initial review processes.

Importantly, the data request states:

> "Whenever available, we are requesting **electronic copies** in their original formats (i.e., workable excel spreadsheets showing all formulae and functional models) over hard copy documentation, scans, or PDFs. <emphasis added>"

Electronic documents, not scans, greatly improve the evaluation process, as discussed in greater depth, below.

E.2 Implementation Assessment Process

The following is an outline of the steps involved in conducting an engineering desk review as implemented in the lower rigor assessment effort.

- Review tracking system description, costs, quantities, fuels, and savings values
- Review facility location, climate zone, and type of work conducted
- Review the project description, application documents, preliminary audit, post-installation reports, and measure specifications
- Determine the scope of the project and types of measures installed

- Initiate a follow-up data request if any documentation is missing, illegible, locked (i.e., spreadsheets or external executables) or if the scope is not clearly defined
- Review the program manuals and identify any exceptions to standard CPUC guidelines
- If there is any doubt that the facility may not be operational or never completed, make a phone call to the IOU representative and/or the customer to verify (planned)
- Determine measure location (exterior, space conditioned, heated, cooling and HVAC system types to determine potential interactive effects and kW coincidence factors)
- Determine the baseline type assigned by the IOU (e.g. normal replacement, early replacement, system optimization, add-on measure, or new construction/gut rehab)
- If required, conduct a literature search for equipment specifications, publicly available information on the project, aerial photograph, and history of the facility
- Investigate measure baseline and useful life issues (e.g., code or standard industry practice for new construction or measures at the end of their useful life, measure life)
- Determine if measures meet program and CPUC eligibility requirements
- Review engineering calculations and the measure and baseline efficiency specifications
- Compare results to work papers, Technical Resource Manuals, DEER values, and prior evaluation reports
- Determine appropriateness of input variables, range of values, algorithms and identify any omissions (e.g., weather regression, peak vs. average kW, etc.)
- Investigate project cost estimates and determine IOU's use of full versus incremental cost basis for determining rebate caps
- If there is any ambiguity that a literature search cannot fulfill, contact vendor to discuss project and any issues with installation, remaining useful life of replaced equipment, etc.
- Determine project and measure eligibility according to program rules and CPUC policy
- Evaluation project manager in consultation with the project evaluation lead engineer performs engineering quality control review of Lower Rigor Assessment
- Lower rigor assessment results compared to other projects and again reviewed for internal quality control and revised as necessary
- Lower rigor assessment document submitted to CPUC/ED for review and approval and revised as necessary

To facilitate the desk review process the evaluation team developed a Lower Rigor Assessment Form, displayed in Appendix C. The first parts of the form include project information and a review of the project results. The Form also has a section dedicated to overall findings summary and general project review. The LRA form was completed for both the lower rigor samples as well as the Full M&V samples.

Appendix F

Scatter Plots of Ex-ante and Ex-post Savings by IOU

Table 0-1: Ex-ante and Ex-post Savings (PG&E Electric)

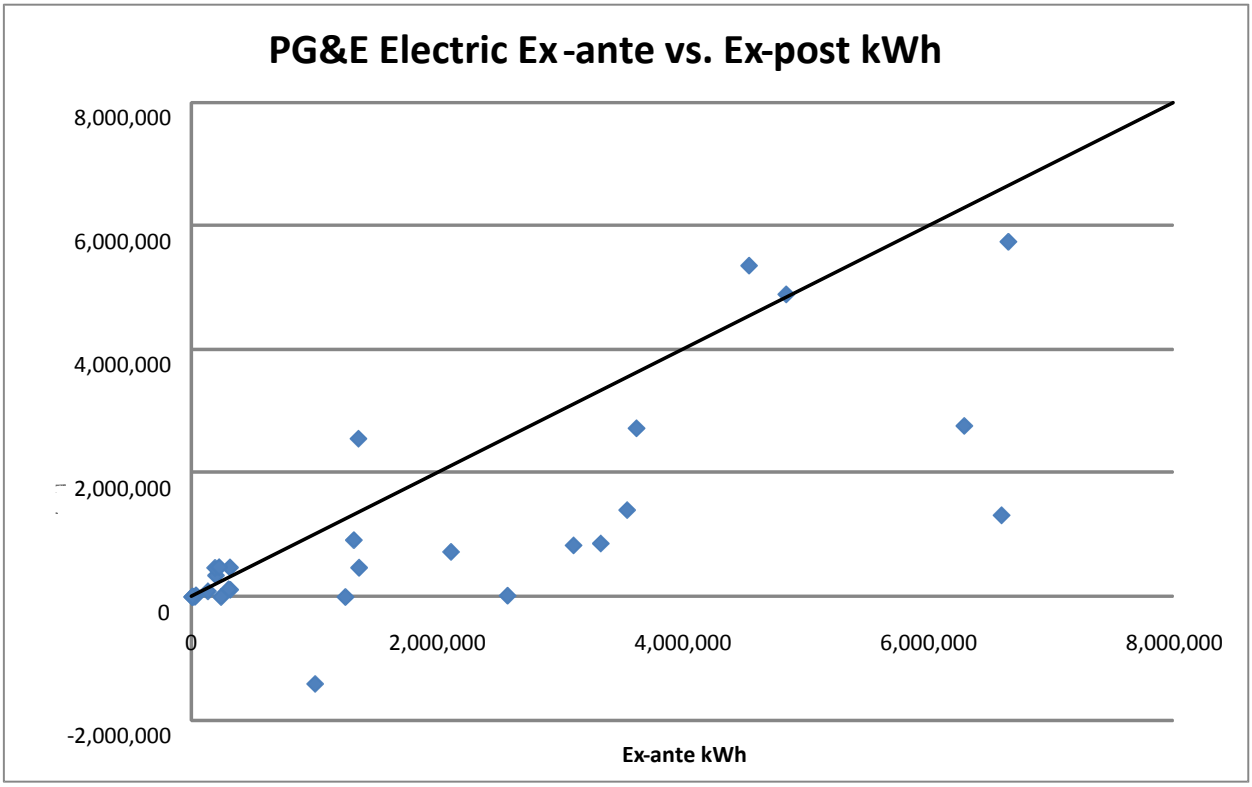


Table 0-2: Ex-ante and Ex-post Savings (PG&E Gas)

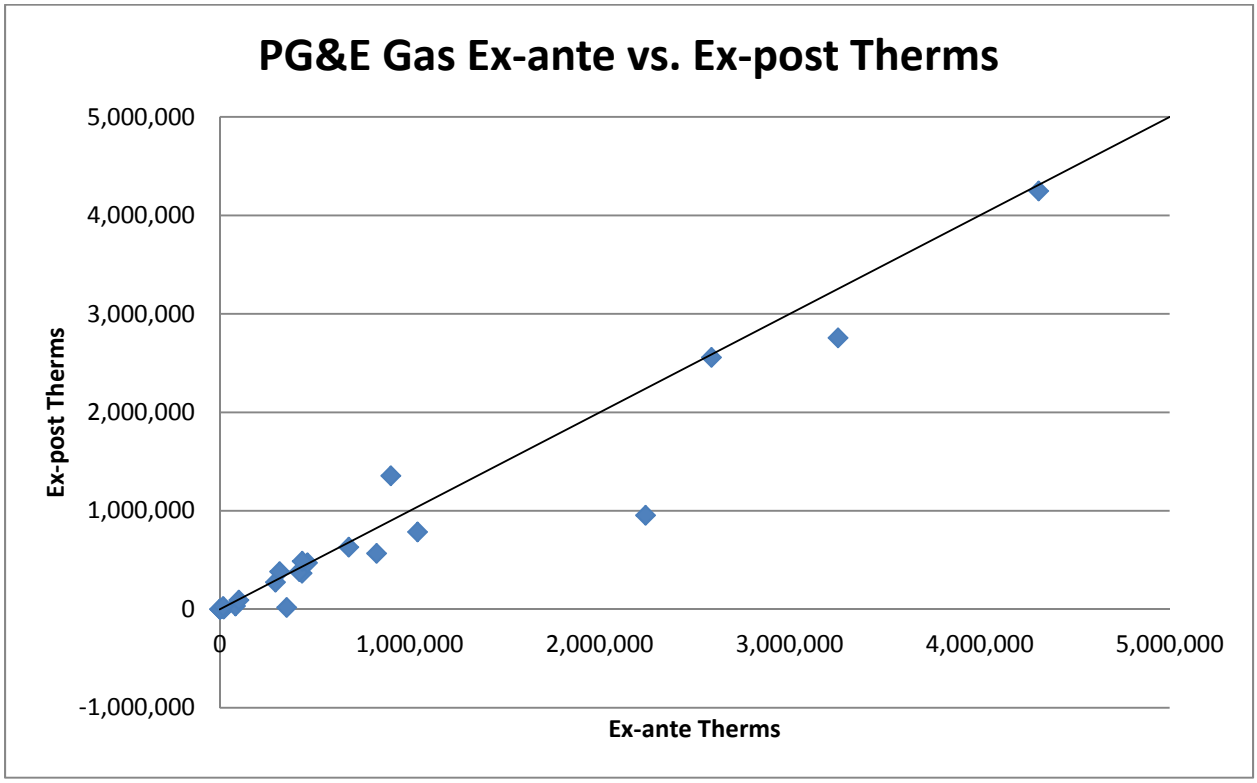


Table 0-3: Ex-ante and Ex-post Savings (SCE Electric)

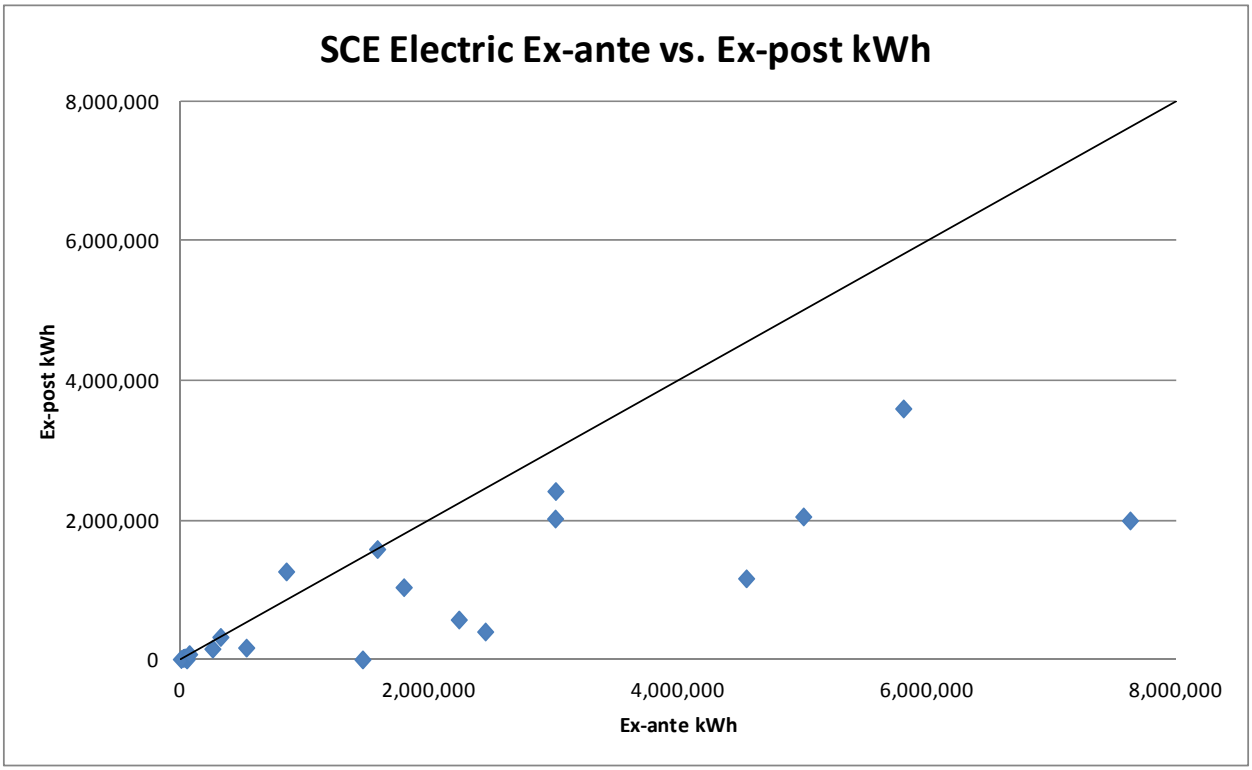


Table 0-4: Ex-ante and Ex-post Savings (SDG&E Electric)

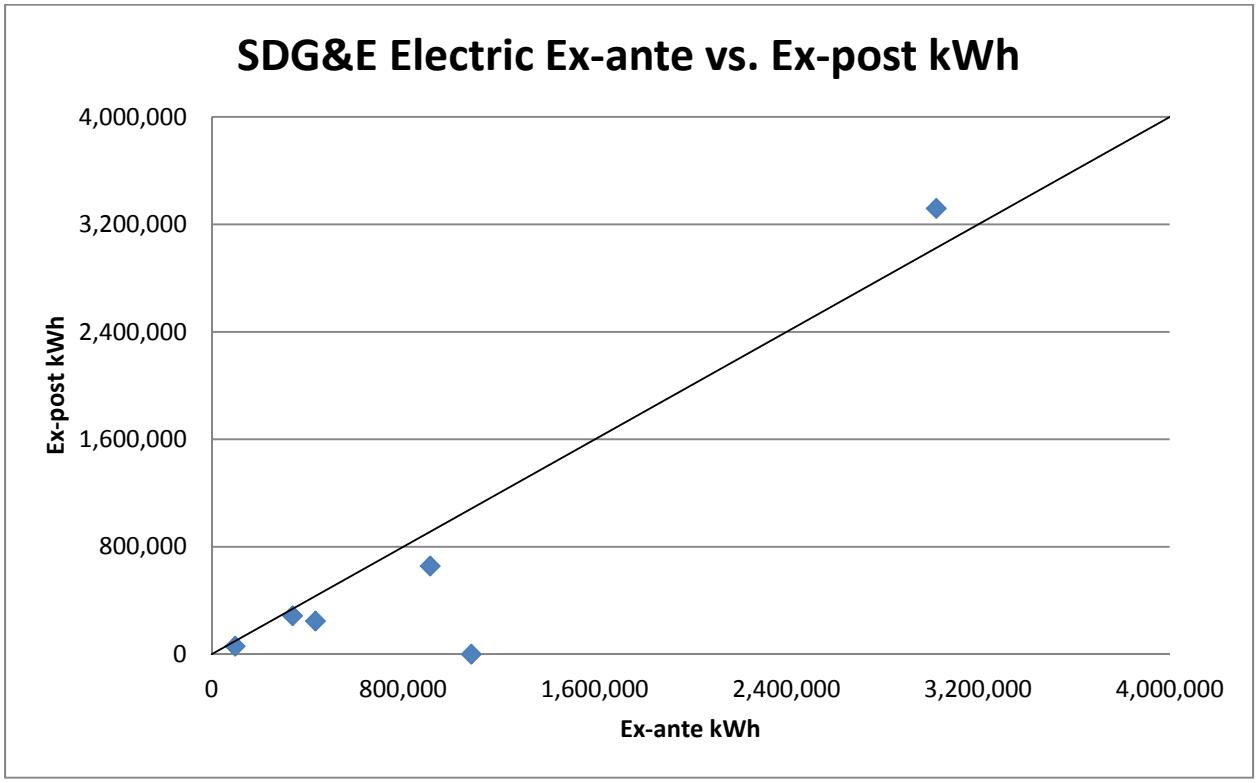
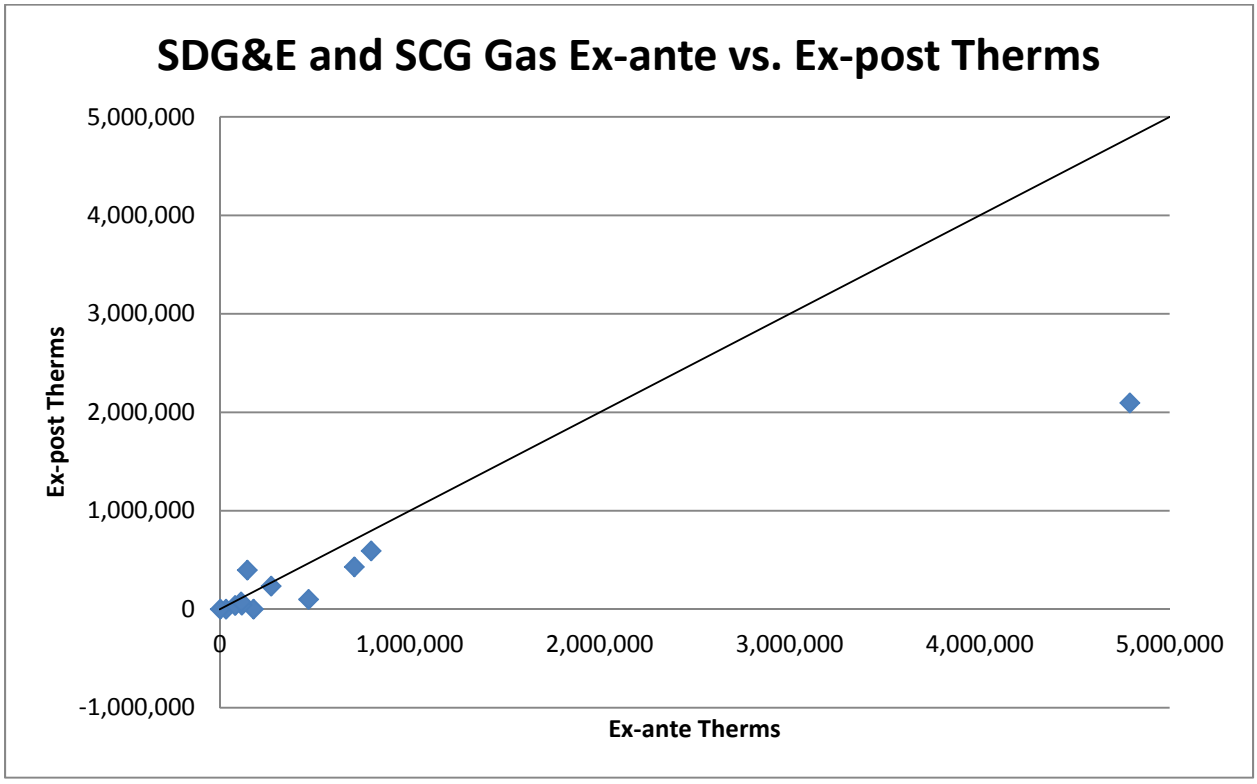


Table 0-5: Ex-ante and Ex-post Savings (SDG&E and SCG Gas)



Appendix G

Additional Selected M&V Project Descriptions and Reasons for Discrepancies

Purpose of the M&V Project Descriptions

This appendix presents several project descriptions that were constructed from the M&V complete sample points that are not included in the main report. These descriptions are geared toward enabling a more thorough understanding of the types of projects encountered and the reasons for discrepancy between ex-ante and ex-post savings. Note that all M&V results are preliminary for this interim report and subject to change.

Additional M&V Project Descriptions

Site E002 – New Heat Exchanger at Refinery – Therm GRR 98.5%; Operating Condition Difference, Minor Changes

The IOU analysis used a production rate for savings calculation. This production rate changed slightly for the ex-post analysis. Actual SCADA data from the refinery over long periods gave a good accuracy and confidence in ex-post savings estimates, which closely matched ex-ante estimates.

Site E006 – Newer Furnace Coating at a Refinery – Therm GRR 99%; Operating Conditions Difference, Minor Changes

The applicant submitted this measure for a new furnace coating. This coating appeared to be different and above standard practice of cleaning to remove soot and restore furnace efficiency, a common maintenance practice. The project is still under review as the measure may better fit into an emerging technologies or retrofit program. An effective useful life (EUL) of eight (8) years was claimed and accepted but may also be reviewed.

Site E015 – Repairing Steam Leaks – Therm GRR 69%; Operating Conditions Difference, Some Equipment was Non-functional or Removed

Some equipment was non-functional, decommissioned, or continued experiencing leaks at this refinery.

Site E017 – Installing Pump Off Controllers (POCs) – kWh GRR 13%, kW GRR 13%; Operating Conditions Difference

Higher post-installation run time and kW usage at the rod beam pumps caused much lower ex-post savings.

Site E021 – Healthcare Facility Renovation – kWh GRR 114%, kW GRR 5849%, Therm GRR 5%; Equipment Specification Issue

This healthcare facility underwent a major renovation which included installing high efficiency lighting, installing dual pane windows and incorporating high efficiency airside HVAC systems. Lighting energy intensity changed to an ex-post LPD of 0.859 W/ft2 as compared to the ex-ante LPD of 1.036 W/ft2. Ex-post analysis calibrated the EnergyPro model to the actual building cooling load where as the ex-ante EnergyPro model was not calibrated. The ex-ante Energy Pro model overestimated gas usage, leading to a very low realization rate for gas savings. The ex-ante model showed an annual energy consumption of 699,000 therms, whereas the actual gas bills showed only 257,000 therms during the ex-post evaluation bill verification process. The ex-post energy model was calibrated to the actual billing data, which yield a gross realization rate of 5% for the gas savings.

Site E030 – Steam Traps at a Refinery – Therm GRR 91%; Calculation Method Difference

There were over 100 steam traps replaced at a refinery. The evaluation team verified that that a sample of the steam traps were replaced. The ex-ante calculations did not include savings from steam traps that failed closed, which was appropriate. The evaluation team used the Spirax Sarco methodology which is accepted in the steam industry. The IOU method was unclear as the IOU did not submit energy savings calculations with a workable spreadsheet and delineation of savings calculations for review.

Site E059 – Putting VFD on an Electric Pump – kWh GRR -71%; kW GRR -71%; Inappropriate Baseline Issue

The ex-ante calculation assumed a baseline of an uncontrolled electric pump with savings attributed to a VFD on that pump, although an existing engine-driven pump fueled by non-IOU waste gas was actually in place. Load on the electric grid was actually increased by this measure. ***This project has a negative gross realization rate (-71% for kWh and kW), signifying that this project actually increased electrical energy use and increased grid impacts, without any accompanying IOU-provided natural gas reduction.***

Site E060 – New Construction Project for Greenhouse – Therm GRR 92%; Calculation Method Difference, Minor Changes

For this greenhouse project, ex-ante energy calculations using the eQuest building simulation model, building components and solar insulation values were different in the ex-post analysis, leading to slightly lower savings (despite monitoring which found higher interior temperatures in the ex-post analysis, which would tend to increase savings). This project illustrates the ways that operating conditions can change to increase or decrease savings, and also to offset one another.

Site E066 – Pool Cover – Therm GRR 39%; Inappropriate Baseline and Calculation Method Difference

An incorrect baseline (no pool cover) was used in the ex-ante analysis, which led to high ex-ante savings. Additionally, the analysis run did not include the impact of the facility's solar hot water heating system. Ex-ante calculations used an 83% heating plant efficiency as compared to the ex-post value of 78%. Each of the above factors impacted the ex-post savings. Ultimately, the evaluation team changed the calculation method from the Energy Smart Pools (ESP) calculator to spreadsheet billing analysis using PRISM regression techniques because ESP has significant input limitations which can affect the validity of the analysis. Although the billing analysis clearly indicates a decrease in facility energy use, the inappropriate ex-ante baseline led to a low realization rate.

Site E084 – Retrocommissioning in a Retail Multistory Building – kWh GRR 0%; kW GRR 0%; Ineligible Measure

The RCx projects were implemented at two separate store buildings. The implemented measures were VFDs on relief fan motors, a re-commissioned economizer sequence of operation for AC-1 and AC-2, and scheduled AHU operation in the other. PG&E's NRR-DR Calculation Software was used to estimate the energy savings for this project. This project is a zero saver because the ex-post evaluation couldn't be conducted at this site. The facility was non-operational and vacant.

Site E087 – Municipal Pumping Application – kWh GRR 219%, kW GRR 263%; Operating Conditions Issue

This measure involved optimization of two 125 hp and one 400 hp motor at a municipal water authority. There were three IOU tracking records in the database for this project. The IOU used the operating conditions from an atypical period. A very infrequent mandatory water rationing policy was in effect in 2009 and hence the peak demand was less and the operational hours were lower than typical in the ex-ante conditions. The 400 hp pump was not operated in this period.

The evaluation team analysis relied on a billing analysis after the water rationing period, as most of the load was on these motors.

Site E091 – New Construction Whole Building Project at a University – kWh GRR 449%, kW GRR 64% and Therm GRR 451%; Operating Conditions Issue

This is a new construction Whole Building project that implemented various energy efficiency measures. The implemented measures include (1) occupancy sensors; (2) high efficiency lighting fixtures; (3) VFDs on fans and pumps; (4) premium efficiency motors; (5) low-e glazing; (6) high efficiency boiler; (7) built-up VAV systems; and (8) dual duct system with indirect evaporative cooling. The IOU used the Energy Pro simulation tool to estimate the savings for this new construction project. The evaluation team used the existing Energy Pro model, but took a calibrated approach to evaluate the savings for this Whole Building project. The modeling calibration included adjusting glazing U factor, fan operating schedule, infiltration rates, cooling and heating set points and many other performance parameters that were collected from the as-built plans and building EMS. Finally, the model was calibrated to monthly building electric consumption. The major drivers for these higher realization rates are due to the difference in the building operating schedule, reduction in building chilled water demand and elimination of evaporative cooling from the ex-ante model.

Site E103 – Savings By Design Whole Building Project at a Community College; kWh GRR 40%; kW GRR 11%, Therm GRR 35%; Measure Count Issue, Incorrect HVAC System Type and Excess Floor Area Included in Simulation Model

This is a new health care facility occupying two new buildings on a college campus with a total floor area of 51,409 ft^2. Building 1 has a floor area of 32,671 ft^2 and Building 2 has a floor area of 32,671 ft^2. A central chiller plant serves both buildings. The project for Building 2 involved the high efficiency chillers and boilers, premium motors, VFDs, low-e double pane glazing, EMS controls on all HVAC systems, and above-standard roof insulation. The ex-ante analysis showed that the buildings consumed 11.9% less energy than the Title 24 2005 standards. The IOU analysis used the Energy Pro simulation tool to estimate the savings for this new construction project. The evaluation team's analysis used the Energy-Pro model provided by the IOU calibrated to as-built conditions. The ex-post calibration included adjusting equipment efficiency, building schedules and other relevant performance parameters to reflect the actual building operation. The low realization rate for this project was due to differences in building operating schedules and changing the simulation model from two buildings to one building to match the scope of the project.

Site E113 – Installation of EMS in a Retail Store – kWh GRR 117%; kW GRR – 13% and Therm GRR 523%; Inappropriate Baseline / Equipment Specification / Operating Conditions

The energy efficiency measures cover the installation of new EMS. As part of the EMS retrofit the following capabilities have been implemented: 1) Control the occupied cooling and heating set points during the occupied hours; 2) Control the unoccupied setback temperatures; 3) The interior lights are controlled based on the store hours and the exterior lights were controlled based on sunset time and sun rise time; 4) HVAC&R refrigeration equipment are sub-metered; and 5) HVAC units are operated in Auto modes. The IOU used eQuest energy modeling software to calculate savings for this project. The evaluation team used the IOU eQuest model and calibrated it to evaluate savings for this project. The major parameters that were used for calibration were room temperature set points, operating schedules, equipment load, and occupancy load. The higher gross realization rates for this project were due to the three following reasons:

1. The baseline building annual kWh consumption is increased from original 181,710 kWh to existing 394,921 kWh after calibrations. This leads to a higher AC power savings potential when nightly setback and fan cycle was implemented.
2. The actual room temperatures are different from the proposed ones. For example, the actual stock room temperature is 1°F lower than the proposed, while the sales zone room temperature is 1°F higher than the proposed.
3. The electrical input ratios of AC units serving the sales area are higher than the inputs in the original model according to the unit nameplate. These changes lead to a higher power reduction at the same cooling load reduction.

F007- VFD on Cooling Tower Fans and Re-piping on Cooling Pumps-kWh GRR- 40.9% and kW GRR- 42.4%; Inappropriate Baseline

The project is a new construction/addition project at a refinery. The new process cooling water loop includes a new three-cell cooling tower, filtering systems, three cooling water pumps, and a cooling water (CW) distribution system. Under the design condition, two CW pumps are running and one is spare. The energy savings resulted from the following measures:

1. Installed 42” pipes instead of 36” standard size pipes and installed moving filters compared to the standard fixed filters to reduce the new cooling water pump brake horsepower and save pumping power; and
2. Installed VFDs on three 200-hp fans of a three-cell cooling tower to save fan power.

The IOU used a spreadsheet analysis to estimate the savings for this project. The evaluation team collected time series metered data and performed a spreadsheet analysis to evaluate the savings for this project. The IOU estimated the baseline pump efficiency of 59.7% and the post pump efficiency of 89% whereas the evaluation team's calculation revealed that the both baseline and post pump efficiencies were 88.5%. The savings from improving pump efficiency is eliminated. Additionally, the IOU calculation assumed two pumps operating at all the times, but the evaluation team's site visit revealed that only one pump was operating after the installation of the measure.

Site F061 – Agricultural Pump Rehabilitation – kWh GRR 0%; kW GRR 0%; Operating Conditions Issue: Well Abandoned

This agricultural pumping project involved the rehabilitation of a 50 hp pump and well used for agricultural irrigation. The evaluation team found that the well had been abandoned and the pump removed because of a failure in the well casing. A new, deeper well with a 125 HP pump motor has been constructed adjacent to the abandoned well.

G016 – Savings By Design – Insulation on New Asphalt Storage Tank – Therm GRR 35%: Baseline Issue

The project installed a new asphalt silo (90' in diameter, 32' tall) with improved surface insulation relative to the standard practice condition. Four (4) inches of high temperature fiber glass insulation were installed. The installed insulation was claimed to reduce the surface temperature of the silo from the base case temperature of 140^{o}F to 74^{o}F when the ambient temperature was 65^{o}F and wind passed the silo at 5 mph. Savings are derived from reducing the process heat load placed on the thermal fluid heater, which maintains the asphalt temperature in the storage tank. IOU used DOE's E3Plus heat loss software tool to estimate the savings for this project. The evaluation team's saving analysis was also conducted in the DOE software 3EPlus, but used time series ambient temperature data, and wind speed data for 39 days as compared to a single set of ambient condition and wind speed. The poor realization was primarily due to use of inappropriate baseline and improper ex-ante methodology. The evaluation baseline consists of more insulation, and the significant drop in energy savings is not surprising.

Site G021 – Process Heat Recovery – Therm GRR 0%; Operating Conditions Difference

This project involved the installation of a plate and frame heat exchanger to recover heat from evaporator condensate in a food processing facility. The project diverted evaporator condensate from an existing heat exchanger to a new heat exchanger. The evaluation team found that the new heat exchanger is recovering approximately the same amount of heat as the pre-retrofit system.