

2013-14 Regional Energy Networks and Community Choice Aggregator Programs Impact Assessment

Final Report (without Appendices)



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Executive Summary

This document presents the evaluation report for the impact assessment of the energy efficiency programs offered by the 2013-14 Regional Energy Networks (RENs) and Community Choice Aggregator (CCA). The primary goal of this study was to perform an impact assessment on specific measures offered by the RENs and CCA to develop more reliable estimates of program cost effectiveness.¹ This study report presents results from a set of quick turnaround tasks that update some key impact parameters using primary data collection (for net-to-gross (NTG) analysis) and utilizing results from recent gross ex post impact evaluations (for key nonresidential lighting measures), which are then used to develop more reliable estimates of program cost effectiveness. Furthermore, because most of the ex ante claimed savings are associated with measures that do not have recent impact evaluation findings that can be directly applied, a high level assessment of the ex ante savings assumptions, including a comparison between RENs/CCA and investor owned utility (IOU) ex ante impact assumptions, was made to identify if there are any obvious over- or understatement of savings being claimed. Therefore, this study includes:

- A high level assessment of the gross ex ante savings values being used for all programs claiming ex ante savings. This includes:
 - Reviewing the ex ante work papers and, for the CCA program, correcting errors in the program tracking databases for the ex ante calculations of deemed measures,
 - Comparing the ex ante assumptions used by the RENs and CCA with those used by the IOUs,
 - Updating gross savings values for selected nonresidential lighting measures for the CCA program based on recent CPUC ex post impact evaluations, and
 - Performing a review of a sample of custom lighting applications for the CCA program and updating gross savings values.
- Development of ex post net-to-gross ratios (NTGRs) for selected measures, and
- Estimation of program cost effectiveness using the updated savings values developed in the gross impact assessment and NTGR analysis described above.

In addition, this study documents the non-resource program accomplishments of the RENs and CCA and assesses the ability of the current tracking systems for these activities to support future evaluations (an evaluability assessment). Although no specific attribution of savings was made based on these accomplishments, this documentation of additional activities that are being

¹ A more rigorous ex post impact evaluation is planned for the programs in 2016.

conducted by the programs may provide value beyond that which can be measured by the cost effectiveness tests. Future studies may wish to try to better quantify these non-resource accomplishments, which is why an evaluability assessment has been conducted.

One CCA and two REN Program Administrators (PAs) offer various programs:

- **Marin Clean Energy (MCE)**
 - The MCE Multifamily Program is a program designed to reduce barriers to retrofits by providing technical assistance and incentives to multifamily property owners. Incentives are offered for window film, CFLs, linear fluorescents, LEDs, pipe insulation, and a variety of domestic hot water measures.
 - The MCE Small Commercial Program is a multiple measure program for small commercial high energy use segments. The program reduces barriers to retrofits by providing technical assistance and incentives to building owners. Incentives are offered for CFLs, occupancy sensors, LEDs, linear fluorescents, delamping of linear fluorescents, and selected refrigeration measures.
 - The MCE Single Family Program enables energy and water savings with associated cost reductions through behavior changes, upgrading of appliances, and water conservation measures that affect energy. Program activities include encouraging customers to register for the online My Energy Tool and sending out Home Utility Reports. No measures are rebated under this program.
 - The MCE Finance Pilots Program includes two innovative finance programs to ensure that retrofits are financially competitive and accessible to a broader and more diverse range of property owners. The two financing program elements are On-Bill Repayment (OBR) and a Standard Offer (SO) Energy Efficiency pilot.
- **San Francisco Bay Area Regional Energy Network (BayREN)**
 - BayREN Single Family Home Upgrade is a service available to owners of single family detached homes in the BayREN territory who are customers of PG&E. This program pays incentives for whole house retrofits and offers assistance to customers and contractors going through the process through its Home Upgrade Advisor segment.
 - The Bay Area Multifamily Whole Building Program is a service that allows multifamily property owners to receive free technical assistance designed to lower barriers to multiple measure upgrades through technical and financing assistance. Property owners receive customized scopes of work designed to reduce building energy use and receive incentives for whole building retrofits.
 - The BayREN Codes and Standards Subprogram consists of three components: enforcement of existing codes, training, and sharing best practices for reach codes. The BayREN Energy Efficiency Financing Portfolio contains three programs to help

make energy efficiency upgrades more affordable. The components are: (1) Pay As You Save, (2) Commercial PACE, and (3) Multifamily Capital Advance.

- Southern California Regional Energy Network (SoCalREN)
 - The SoCalREN pilot includes a set of program activities as follows: Single Family Home Upgrade, Multifamily Whole Building retrofits, Local Marketing and Outreach, Contractor Outreach and Training, Green Building Labeling, and Low-Income Single Family Housing Upgrades. Note that through the Single Family Home Upgrade and Multifamily Whole Building program components, SoCalREN provides incentives for both single family and multifamily whole house/building retrofits.
 - Financing options are also made available by SoCalREN to local governments to supplement the on-bill financing offered by the IOUs and, therefore, enable greater investments in deep energy savings.
 - SoCalREN's Regional Energy Center offers comprehensive technical support to local governments and other public entities to enable them to implement deeper and more cost effective energy management practices.

Each program administrator (PA) offers a combination of resource programs (those that claim ex ante savings) and non-resource programs. All resource programs are included in the gross savings assessment, while only a subset are covered under the net-to-gross analysis, as described below. Note that the Financing program elements and the Codes and Standards-related program elements are not included in either portion of the impact assessment as there are separate California statewide evaluations being conducted for Financing and for Codes and Standards.² All other non-resource programs are included in the evaluability assessment and accomplishments documentation.

The resource program savings of the RENs come from the residential sector while the savings from MCE come from both residential and commercial energy efficiency upgrades. The two REN PAs offer the Single Family Home Upgrade and Multifamily Whole Building programs, both of which are whole building retrofit programs with a suite of measures. The MCE program offers a wide variety of energy efficiency measures in both the residential and nonresidential sectors. Note that 91% of the MCE program's claimed electric savings are in the nonresidential sector, and 82% are focused on nonresidential lighting. The MCE's claimed gas savings are

² The Codes and Standards study is the 2013-2014 Codes & Standards Impact Evaluation. The series of CPUC impact evaluations that cover financing programs are: Impact Evaluation #1 – Cross-Cutting Background and Attribution Research, Impact Evaluation #2 – Multiphase On-Bill Financing Study, Impact Evaluation #3 – Annual Snapshot and Verification Study, and Impact Evaluation #4 – End of Cycle Studies: 1) ARRA- Originated and Regional Finance Pilots; 2) Statewide Pilots. The studies are cited in the Energy Division and Program Administrator Energy Efficiency Evaluation, Measurement & Verification Plan, Version 5. May 2015.

focused on residential faucet aerators and showerheads, which comprise 69% of the claimed savings.

As mentioned above, all of these measures are included in the gross impact assessment. However, only the BayREN Multifamily Whole Building Retrofit and the MCE Small Commercial measures are included in the NTG analysis.

Table ES-1 below summarizes the analyses that were conducted for each of the PA’s programs.

Table ES-1: Analyses Conducted for REN and CCA 2013-2014 Programs

PA	Program	Gross Impact Assessment	NTG Analysis	Cost Effectiveness Analysis	Evaluability Assessment	Accomplishments Assessment
BayREN	Single Family Home Upgrade	X		X	X	X
	Multifamily Whole Building	X	X	X	X	X
	Codes and Standards Program					
	Energy Efficiency Financing Portfolio					
SoCalREN	SF Home Upgrade and MF Whole Building	X		X	X	X
	Financing					
	Regional Energy Center				X	X
MCE	Multifamily Program	X		X	X	X
	Small Commercial Program	X	X	X	X	X
	Single Family Program				X	X
	Financing Program					

ES.1 Summary of Findings and Recommendations

This section provides an integrated summary of very high level findings from the analysis presented in this report. Table ES-2 below provides a summary table of all conclusions and recommendations made in the report, including which PA(s) the recommendation is relevant to and the section of the report that supports the conclusion and recommendation. More detailed descriptions of these conclusions and recommendations are provided at the end of each of the relevant sections of the report (Sections 4-7).

Table ES-2: Summary of Conclusions and Recommendations

ID	PA	Section	Conclusion	Recommendation
Gross-1	MCE	4.1.1	MCE did not provide key references for their ex ante assumptions or provide detailed measures descriptions.	MCE should set up an internal process to check the quality and consistency of ex ante data reported to the CPUC and ensure they are providing detailed measure descriptions and references to ex ante assumptions.
Gross-2	MCE	4.1.1	Critical impact parameter fields for savings calculation purposes were not valid or were found to be inconsistent for MCE.	MCE should ensure critical fields needed for savings calculations are filled in and valid
Gross-3	MCE	4.1.1, 4.1.2	Significant variability was found between MCE's claimed ex ante values, corrected ex ante values, and evaluation values for deemed measures.	Collaboration between all stakeholders (i.e., MCE, PG&E, and CPUC) should work to incorporate evaluation results to update ex ante deemed values.
Gross-4	MCE	4.1.3	MCE's ex ante EULs for LED measures were much greater than evaluated estimates for calculated measures, and EUL estimates were not calculated or documented as part of the project calculation workbooks.	MCE should estimate EULs as part of the calculated application process using site-specific operating hours developed for the project, and DEER based service lives.
Gross-5	MCE	4.1.3	Although MCE's measure installations were provided at the activity area level, all calculated lighting projects used DEER default hours of operation.	For calculated measures, MCE should consider either collecting site-specific operating hours that are developed at the activity area in the applications, or applying deemed savings values if they are going to rely on default values.
Gross-6	MCE	4.1.3	MCE's evaluated annual operating hours were generally less than ex ante assumptions for calculated measures.	For calculated measures, if site-specific operating hours are not collected, MCE should utilize the operating hour and coincidence factor values documented in the 2010-2012 and 2013-2014 nonresidential lighting impact evaluations conducted by the CPUC, which were developed by building type and space type.
Gross-7	MCE	4.1.3	While ex ante first and second baselines were documented in MCE's calculation workbooks based on an ER or ROB designation, they were provided as annualized savings with no lifecycle estimates.	MCE should calculate lifecycle savings for all measures as part of their project calculation workbooks and ensure the calculation is done correctly in their claimed database for ER (or dual baseline) measures, which is (first baseline savings * RUL) + (second baseline savings * (EUL-RUL)).

Table ES-2 (Cont'd): Summary of Conclusions and Recommendations

ID	PA	Section	Conclusion	Recommendation
Gross-8	MCE	4.1.3	The evaluation team was only able to update roughly 53% of MCE's first year ex ante claim for calculated measures.	MCE's project calculation workbooks should go through an extensive QC process to validate that the savings estimates in the workbooks are identical to the claimed savings in the tracking data.
Gross-9	BayREN, SoCalREN	4.2.1	The IOU and REN Multifamily Whole Building program tracking data have varying levels of completeness.	IOUs and RENs should adjust data collection and program tracking to ensure all key fields, including participant contact information, measure details, pre-existing conditions, property systems, property details, and utility meter numbers are collected and easily accessible for all completed projects.
Gross-10	BayREN, SoCalREN	4.2.2	BayREN, SoCalREN, and SDG&E all use different approaches to calculating savings for multifamily measures, and these differences may lead to differences in savings estimates for similar measures.	The RENs and IOUs should collaborate and agree on consistent methods to estimate savings for similar multifamily measures.
Gross-11	BayREN, SoCalREN	4.2.4	Matching BayREN and SoCalREN program data to billing data by different accountIDs was largely unsuccessful, likely because of the high turnover rate for multifamily tenants.	The RENs should collect meter numbers for multifamily participants to allow for improved matching of program and billing data.
Gross-12	BayREN, SoCalREN	4.2.2	The inability to calibrate to actual bills for BayREN and SoCalREN multifamily participants may lead to savings estimates that are either overestimated or under the targeted per-project savings threshold for the program.	The RENs should have access to building level billing data so the savings assumptions and models can be calibrated to actual customer bills.
Gross-13	BayREN, SoCalREN	4.2.3	It was difficult to validate the program claimed savings via an engineering desk review for BayREN and SoCalREN multifamily participants because of factors such as interactive effects, stacking effects, and differences in baseline assumptions.	Simulation models would provide a more effective approach to validating the claimed savings for multifamily projects, and site visits would allow verification of the key model inputs.

Table ES-2 (Cont'd): Summary of Conclusions and Recommendations

ID	PA	Section	Conclusion	Recommendation
Gross-14	BayREN, SoCalREN	4.2.5	Although the RENs have assumed early replacement savings for all multifamily measures, this research indicated that a substantial portion of projects may not qualify for early replacement because of planned improvements, installation of new equipment, or replacement of equipment that was in poor condition.	The RENs should set up a survey for multifamily participants at intake to better determine the appropriate baseline for each project and measure.
Gross-15	BayREN, SoCalREN	4.2.5	While the RENs have assumed an early replacement baseline on their first year savings for multifamily projects, they are not always calculating lifecycle savings to reflect a change in baseline after the end of the project RUL.	The RENs should calculate lifecycle savings for early replacement multifamily projects using the early replacement baseline for the RUL period, then using a code baseline for the remainder of the EUL: Lifecycle Savings=(RUL*[[Savings]]_ER)+((EUL-RUL)*[[Savings]]_Code)
Gross-16	BayREN, SoCalREN	4.2.2	Though the RENs indicated they use project-level savings-weighted EULs (and the associated one-third EUL for the RULs) for multifamily projects, the application of this logic leads to the potential of miscalculation of lifecycle savings and the tracking database did not suggest this logic was actually being implemented.	The RENs should be sure to use the correctly weighted and calibrated EUL and RUL for multifamily projects that results in the correct lifecycle savings values, rather than the 18-year EUL currently reported in the tracking database.
Gross-17	BayREN, SoCalREN	4.3.1, 4.3.2	The RENs utilized five different sets of workpapers during the 2013-2014 single family Home Upgrade program.	All implementers should use consistent workpapers for the single family Home Upgrade program. If workpapers are not approved by the CPUC, the same set of workpapers should be used throughout the program year..
Gross-18	BayREN, SoCalREN	4.3.1, 4.3.2	The most recent version of the EUCA calculator was not being used by the RENs for the single family Home Upgrade program, which resulted in the miscalculation of lifecycle savings	The RENs should ensure they are using the most recent approved version of the EUCA calculator for the single family Home Upgrade program, or whatever other tool they are using to develop ex ante savings estimates

Table ES-2 (Cont'd): Summary of Conclusions and Recommendations

ID	PA	Section	Conclusion	Recommendation
Gross-19	BayREN, SoCalREN	4.3.1, 4.3.2	CPUC tracking data changed over time for the RENs single family Home Upgrade programs. This problem is bigger than only the Home Upgrade program and is being addressed with the data management team.	The RENs should conduct data quality checks quarterly when single family Home Upgrade program data are submitted.
Gross-20	BayREN, SoCalREN	4.3.1, 4.3.2	There were no common measure codes in the workpapers or tracking data across IOU or REN for the single family Home Upgrade programs.	The RENs should ensure that measure codes represent measures or bundles of measures, and be consistent across implementers for their single family Home Upgrade programs.
Net-1	MCE, BayREN	5.1, 5.2	The research found a net-to-gross ratio of 62% for MCE small commercial measures (weighted by evaluated kWh savings) and 58% for BayREN multifamily measures.	MCE and BayREN should consider using the researched net-to-gross ratio from this study and update them as future evaluation results become available.
CostEff-1	MCE, BayREN, SoCalREN	6.2, 6.5	The RENs' and MCE's tracking data are not in agreement with their 2013-2014 monthly reports.	The RENs and MCE should set up an internal process to ensure that all data sources submitted to the CPUC are in agreement.
CostEff-2	MCE, BayREN, SoCalREN	6.2, 6.5	The quality of the RENs' and MCE's tracking data with respect to cost effectiveness parameters was found to be low.	The RENs and MCE should set up a quality control process where submitted tracking data is run through cost effectiveness to ensure data runs smoothly and the expected TRC and PAC values are returned.
CostEff-3	SoCalREN	6.2	SoCalREN combines its single family and multifamily Home Upgrade program elements into a single program, which makes it difficult to assess the cost effectiveness of each element individually.	SoCalREN should consider breaking its single family and multifamily Home Upgrade program elements into two separate programs or else tracking the costs associated with each element separately to allow for each element to be assessed individually for cost effectiveness.
CostEff-4	MCE, BayREN, SoCalREN	6.2	The TRC and PAC cost effectiveness values for the RENs and MCE include costs associated with various non-resource activities within their resource programs that do not directly benefit or support the resource program.	The RENs and MCE should consider tracking the costs associated with non-resource activities that do not directly benefit the resource elements of their programs to support a more accurate calculation of cost effectiveness.

Table ES-2 (Cont'd): Summary of Conclusions and Recommendations

ID	PA	Section	Conclusion	Recommendation
Non-Resource - 1	MCE, BayREN, SoCalREN	7.1.1, 7.2.1, 7.3.1	The accomplishments documented in each PA's annual report are reasonably reliable and do not tend to overstate what they have achieved. Generally speaking, BayREN's Single Family Home Upgrade and Multifamily Upgrade non-resource accomplishments for 2013-14 could be verified.	The RENs and MCE should archive copies of the databases from which the accomplishments are taken when non-resource accomplishments are reported so that all accomplishments can be verified in the future.
Non-Resource - 2	MCE, BayREN, SoCalREN	7.1.2, 7.2.2, 7.3.2	The databases provided by the RENs and MCE are generally collecting the necessary data to support future evaluations, although more complete information would improve the evaluability of their non-resource efforts.	The RENs and MCE should attempt to gather key contact information, electric and gas SAIDs, and document audit/assessment recommendations and participation in other programs whenever possible and relevant.
Non-Resource - 3	MCE, BayREN, SoCalREN	7.1.2, 7.2.2, 7.3.2	MCE and BayREN have a unique customer identifier, but it is not used in all of their customer databases, and SoCalREN does not have a unique customer identifier.	MCE and BayREN should track their unique customer identifier on all customer related databases, and SoCalREN should develop a unique customer identifier that is assigned to every customer as they come into contact with someone.
Non-Resource - 4	MCE, BayREN, SoCalREN	7.1.2, 7.2.2, 7.3.2	The quality of the RENs' and MCE's non-resource databases reviewed was inconsistent.	The RENs and MCE should consider reviewing the structure, format, and contents of their databases to improve consistency and usability; developing a data dictionary documenting variable names (with the exception of SoCalREN, who provided data dictionaries with all provided datasets); and documenting calculations.
Non-Resource - 5	MCE, BayREN, SoCalREN	7.1.3, 7.2.3, 7.3.3	The ability to merge the REN's and MCE's databases that track non-resource accomplishments related to energy audits, referrals, site visits, and advisor hotlines to CPUC tracking data is based on the collection of variables that can be used to link the records across sources, such as electric and/or gas service account IDs.	The RENs and MCE should record names, addresses, phone numbers, and e-mail addresses in a consistent format, and collect IOU customer account IDs and service account IDs whenever possible, as part of their non-resource tracking systems in order to increase the ability to merge non-resource tracking records to CPUC tracking data.

Table ES-2 (Cont'd): Summary of Conclusions and Recommendations

ID	PA	Section	Conclusion	Recommendation
Non-Resource – 6	MCE, BayREN, SoCalREN	7.1.3, 7.2.3, 7.3.3	The results of the merge for a sample of non-resource databases provide some evidence that the RENs and MCE are influencing customers to participate in IOU energy efficiency programs.	Future evaluations of the RENs and MCE could replicate this analysis with additional program years and non-resource databases and attempt an attribution analysis in order to quantify the benefits of the non-resource activities.

Gross Assessment

The results of the gross assessment on MCE's small commercial and multifamily measures indicate that ex ante lifecycle savings for gross kW, kWh and therms are overestimated, with resulting gross realization rates of 76%, 80% and 97%. The evaluation team proposes specific recommendations summarized above in Table ES-2 that would improve the quality of the ex ante data reported to the CPUC by providing detailed measure descriptions and references to ex ante assumptions, and ensure that critical fields needed for savings calculations are filled in and accurate. Recommendations are also made on ways to improve ex ante estimates by utilizing recent relevant CPUC impact evaluation results and methodologies.

Although this evaluation did not update gross savings values for the RENs' multifamily measures, there is not a high level of confidence in the reliability of these values either. This statement is based on the following findings:

- The engineering review methodology used in this evaluation was unable to replicate the savings profiles for programs that claim whole building savings over existing baselines,
- The consumption analysis indicated that more than a quarter of the sites had a first year savings to annual bill ratio outside of a typical range (either less than 10% or over 50%), and
- The baseline analysis indicated that the programs claimed 100% early replacement, but participant survey responses indicated that this was not the case.

Recommendations relevant to the REN multifamily measures are also made that will ideally lead to more consistent savings values across Program Administrators, aid future evaluation efforts by collecting meter numbers to support a billing analysis, and have results more accurately reflect baseline conditions by classifying installations as either early replacement or replace on burnout.

With respect to the REN single family measures, inconsistencies between the RENs and IOUs make it difficult to assess the reliability of the current savings values. Also, a previous version of the Energy Upgrade California® (EUCA) calculator was being used by SoCalREN which incorrectly resulted in lifecycle savings being highly negative for a number of measures. This caused program level lifecycle savings, and therefore TRC and PAC ratios to also be negative (i.e., the savings claim indicated an increase in usage as a result of the installed measures).

Recommendations are made encouraging more consistency in the methods and tools used among all of the implementers for single family measures. Additional recommendations are suggested that will make future workpaper reviews more effective.

Net-to-Gross Assessment

The net-to-gross assessment was performed only for MCE small commercial measures and BayREN’s multifamily measures.³ Ex post NTGRs are found to be lower than ex ante estimates as follows: MCE small commercial ex post NTGRs weighted by kWh are 0.62 compared to the ex ante NTGR of 0.86; BayREN multifamily ex post NTGRs are 0.58 compared to the ex ante NTGR of 0.85.

MCE’s small commercial NTGR is compared to the NTGRs from recent CPUC evaluations for various groupings of program types (e.g., deemed, direct install, third party and LGP program groups), which offered similar measures. Results are very similar and are not statistically significantly different. Therefore, there is no indication that MCE’s program delivery is resulting in lower free ridership than other IOU programs.

Table ES-3 presents the final reported and evaluated net lifecycle MW, GWh, and MMTherms along with the associated net realization rates after applying the results of the gross and NTG assessments. Reported values are generated from the PAs’ program tracking data submitted to the CPUC. The negative realization rates for SoCalREN single family measures are a result of the reported savings values being negative and corrected to be positive. Other than these negative values, and the ex ante pass-through values for BayREN single family and SoCalREN multifamily measures, realization rates are in line with what is typically seen in similar IOU program evaluations.

Table ES-3: Comparison Between Reported Versus Evaluated 2013-14 Net Lifecycle Savings with Net Realization Rates

Program Name	Reported Net Lifecycle			Evaluated Net Lifecycle			Net Realization Rates		
	MW	GWh	MM-Therms	MW	GWh	MM-Therms	MW	GWh	MM-Therms
BayREN-Multifamily	3.0	24.3	2.6	2.1	16.6	1.8	68%	68%	68%
BayREN-Single Family	5.7	1.8	0.7	5.7	1.8	0.7	100%	100%	100%
MCE-Multifamily	0.0	0.6	0.1	0.0	0.5	0.1	70%	88%	89%
MCE-Small Commercial	1.2	9.0	(0.0)	0.7	4.9	(0.0)	61%	55%	52%
SoCalREN-Multifamily	0.4	2.6	(0.0)	0.4	2.6	(0.0)	100%	100%	100%
SoCalREN -Single Family	(0.4)	(1.9)	(0.4)	1.4	0.9	0.2	-342%	-49%	-45%

³ The MCE multifamily program had only nine unique participants and the SoCalREN multifamily program had only two unique participants. These small populations were not considered large enough to provide a reliable net-to-gross ratio (NTGR). Furthermore, there was no existing NTGR algorithm or survey battery for single family Home Upgrade participants for this study to utilize, so this program was not evaluated either for NTGRs.

Cost Effectiveness Analysis

Table ES-4 presents the projected, reported and evaluated TRC and PAC ratios by program for the 2013-2014 program years. Projected TRC and PAC values come directly from the PAs’ program implementation plans (PIPs).⁴ Reported TRC and PAC values are generated using the data from the PAs’ program tracking data and program cost information submitted to the CPUC. Because the BayREN single family savings values are all ex ante pass through, the evaluated TRC and PAC values are the same as the reported values. Also, the corrected SoCalREN savings values for single family have resulted in positive TRC and PAC values, as expected. Otherwise, evaluated results have changed from reported in roughly the same proportion as the net realization rates presented above.

For the most part, there were very little program activities and program-related costs during the 2013 program year. The MCE small commercial program, did however, have some level of activity that occurred in 2013. Because 2013 was a start-up year, the TRC and PAC ratios were also calculated for just the 2014 program year, as shown in Table ES-5. The only values that changed significantly were for the MCE small commercial program. The TRC and PAC ratios increased when looking only at 2014, as expected. Given that the evaluated program period occurred during ramp up, one might also expect to see increased levels of participation, which may change their TRC and PAC values.

Table ES-4: Comparison Between Projected, Reported and Evaluated TRC and PAC Ratios for the 2013-14 Program Period

Program Name	TRC Ratios			PAC Ratios		
	Projected	Reported	Evaluated	Projected	Reported	Evaluated
BayREN-Multifamily	0.67	0.39	0.28	0.97	0.44	0.30
BayREN-Single Family	0.56	0.05	0.05	1.29	0.06	0.06
MCE-Multifamily	1.06	0.22	0.21	2.42	0.24	0.21
MCE-Small Commercial	1.94	1.10	0.76	9.36	1.28	0.73
SoCalREN-All*	0.74 (elec) 0.51 (gas)	(0.04)	0.02	1.26 (elec) 0.79 (gas)	(0.04)	0.03

*SoCalREN projected separate TRC and PAC Ratios for gas and electric fuels.

⁴ The MCE, BayREN and SoCalREN program implementation plan can be retrieved using the following urls:
http://eestats.cpuc.ca.gov/EEGA2010Files/MEA/PIP/2013/Clean/MEA%20PIP_5%207%2013_final.pdf
http://eestats.cpuc.ca.gov/EEGA2010Files/BayREN/PIP/2013/Clean/A.12-07-001%20Supp%2002_Appendix_A_BayREN_PIP_Revised%20091813%20clean.pdf
http://eestats.cpuc.ca.gov/EEGA2010Files/SoCalREN/PIP/Clean/2014%2002%2014_Amended%20SoCalREN%20PIP_Clean%20Final.pdf

Table ES-5: Comparison Between Projected, Reported and Evaluated TRC and PAC Ratios for the 2014 Program Year

Program Name	TRC Ratios			PAC Ratios		
	Projected	Reported	Evaluated	Projected	Reported	Evaluated
BayREN-Multifamily	0.67	0.38	0.27	0.97	0.44	0.30
BayREN-Single Family	0.56	0.05	0.05	1.29	0.06	0.06
MCE-Multifamily	1.06	0.25	0.25	2.42	0.28	0.26
MCE-Small Commercial	1.94	1.52	1.15	9.36	1.95	1.05
SoCalREN-All*	0.74 (elec) 0.51 (gas)	(0.05)	0.03	1.26 (elec) 0.79 (gas)	(0.06)	0.04

*SoCalREN projected separate TRC and PAC Ratios for gas and electric fuels. Furthermore, SoCalREN TRC and PAC are for their multifamily and single family claims combined. The program costs are not reported by multifamily versus single family in the tracking data, so calculating an individual TRC and PAC was not possible.

The TRC and PAC values for MCE were compared to three PG&E programs that have a similar distribution of measure mix and participant characteristics. Table ES-6 presents a comparison of the MCE Small Commercial program and the PG&E small commercial lighting and refrigeration focused programs. Shown are the number of participants, net lifecycle savings (evaluated for MCE and the RENs, ex ante for the IOUs), and the TRC and PAC ratios. The MCE Small Commercial program was found to have TRC and PAC ratios that are less than half the size of PG&E’s Madera⁵ and Energy Fitness⁶ programs, but not that significantly different from PG&E’s Local Government Energy Action Resource⁷ (LGEAR) program. Participation levels are lower by an order of magnitude compared to the LGEAR and Energy Fitness program, and about half that of the Madera program. Given the relatively small service territory of MCE, it should be expected that their participation levels are relatively low.

⁵ Pacific Gas and Electric Company, 2013-2014 Energy Efficiency Portfolio Local Program Implementation Plan: Government Partnerships – Madera – PGE211012, April 23, 2013.

⁶ Pacific Gas and Electric Company, 2013-2014 Energy Efficiency Portfolio Local Program Implementation Plan: Third Party – Energy Fitness Program – PGE210113, January 14, 2013.

⁷ Pacific Gas and Electric Company, 2013-2014 Energy Efficiency Portfolio Local Program Implementation Plan: Government Partnerships – Master – PGE211005-1, April 23, 2013.

Table ES-6: Comparison of 2013-14 Savings and Cost Effectiveness among MCE and PG&E Small Commercial Lighting/Refrigeration Programs

Program Name	Number of Participants	Net Lifecycle Savings			Cost Effectiveness	
		MW	GWh	MMTherms	TRC	PAC
MCE-Small Commercial	85	0.7	4.9	(0.0)	0.76	0.73
PGE-Energy Fitness	658	18.4	94.0	(0.3)	1.99	1.99
PGE-LGEAR	4,805	15.6	176.2	(0.5)	0.82	0.88
PGE-Madera	117	1.4	8.4	(0.0)	1.70	1.66

The REN Home Upgrade and Whole Building Retrofit programs’ TRCs and PACs were compared to the IOU Home Upgrade and Whole Building Retrofit programs, as shown in Table ES-7. Although the BayREN multifamily program’s TRC and PAC are also significantly below 1.0, they are in line with the IOUs’ programs. (The IOUs do not separate out costs for their single family Home Upgrade and multifamily Whole Building programs, so TRCs cannot be developed separately for single family and multifamily components.) The REN and IOU Home Upgrade and Whole Building programs all have TRCs in the range of 0.02 and 0.21. The SoCalREN program, which is primarily comprised of single family home upgrades, and the BayREN single family program have TRC and PAC values that are barely positive and are significantly lower than the other IOU programs which, as mentioned above, do not break out single family and multifamily components. Given the similarity in REN and IOU TRC and PAC values, it is unlikely that these program types will achieve values that are near or above 1.0, without any major programmatic structural change. However, there are other important objectives that these programs strive to achieve, such as serving hard-to-reach customers and providing a greater depth of retrofit in the measures installed. These issues are discussed in greater detail below.

Table ES-7: Comparison of 2013-14 Savings and Cost Effectiveness among REN and IOU Home Upgrade and Multifamily Whole Building California Programs

Program Name	Number of Participants	Net Lifecycle Savings			Cost Effectiveness	
		MW	GWh	MMTherms	TRC	PAC
BayREN-Multifamily	95	2.1	16.6	1.8	0.28	0.30
BayREN-Single Family	684	5.7	1.8	0.7	0.05	0.06
SoCalREN-Multifamily	2	0.4	2.6	(0.0)	0.02*	0.03*
SoCalREN - Single Family	120	1.4	0.9	0.2	0.02*	0.03*
PGE-Home Upgrade and MF Whole Building	4,931	86.7	66.7	15.3	0.23	0.83
SCE-Home Upgrade and MF Whole Building	1,700	29.9	22.8	2.0	0.21	0.35
SCG-Home Upgrade and MF Whole Building	2,669	0.0	11.6	4.7	0.24	0.48
SDGE-Home Upgrade and MF Whole Building	642	5.6	4.0	0.6	0.08	0.14

*The SoCalREN TRC and PAC are for their multifamily and single family claims combined. The program costs are not reported by multifamily versus single family in the tracking data, so calculating an individual TRC and PAC was not possible.

Recommendations are made that could significantly improve the reporting accuracy of ex ante claimed cost effectiveness, savings and cost values for all the REN and MCE programs. This study found significant issues with the values provided that led to the miscalculation of first year and lifecycle savings values, and TRC and PAC ratios (which in some cases overstated the TRC and PAC values, and in another case resulted in a negative TRC value implying the program caused an increase in usage as a result of the installed measures). A comparison between the tracking data and the monthly report (2013-2014 inception-to-date fields) showed discrepancies in program expenditures, demand reduction, energy savings, and gas savings that varied from 1% up to 87,540%. Section 6 describes in more detail many of the issues found and provides some suggestions to improve future reporting of key information that leads to the assessment of cost effectiveness. The following section summarizes these issues.

Tracking Data Quality and Reliability

A number of issues arose related to the quality and reliability of the program tracking data that were received from the PAs, which are used to determine ex ante savings claims and are key inputs to calculating TRC and PAC cost effectiveness metrics.

One major hurdle encountered with the gross assessment for MCE's Small Commercial and Multifamily programs was the difficulty of tracking the source of ex ante assumptions. MCE did not provide adequate references for their deemed measures for all ex ante assumptions in their program tracking data, which could have been either specific references from the DEER or a workpaper. Also, necessary fields from the MCE tracking data that were left blank include: RUL ID, EUL ID, NTG ID, ex ante source, version of source, description of source, and measure code. Furthermore, measure descriptions were not detailed enough to determine baseline conditions or other specifics about the measure being installed. There is also a measure application type designation (e.g., ER, ROB) that describes whether a given measure should be calculated with a single baseline or dual baseline. MCE claimed an ER designation for some installations, yet failed to provide second baseline UES values making calculations of lifecycle savings values impossible.

When comparing the deemed impact parameters provided in the program tracking data to those documented in DEER (which are the correct values to be used), it was found that approximately two-thirds of the energy savings for the multifamily program and all of the energy savings from the small commercial program needed at least one update to an impact parameter. The main reason for discrepancies when comparing to the ex ante savings seems to have been due to reporting errors. For measure groups with small discrepancies, it was found the reason was usually due to small rounding errors in ex ante parameters or a mismatch in building types. For measure groups with larger discrepancies, it was found that improper references were being made to ex ante assumptions. Further, there were claims for the exact same measure code, same measure name, same building type, and same climate zone, yet there were drastically different UES values for each claim. Given the same ex ante categorizations, one should expect the same ex ante assumptions. These types of inconsistencies were found throughout the data to varying degrees.

As part of the custom lighting analysis for MCE's small commercial program, the evaluation team requested the project workbooks and applications for all of the calculated lighting projects that were conducted in 2014. These calculation workbooks detail each of the impact parameters that were used to develop the site-specific ex ante gross savings that are documented in the tracking data. There were discrepancies between the savings calculated in the workbooks and the final savings claimed in the tracking data for roughly half of the projects.

As part of the multifamily Whole Building gross assessment, the evaluation team requested tracking databases for review as part of a database assessment task. As part of this assessment, the evaluation team reviewed key fields to determine if they were adequately populated in the provided databases, including participant contact information, measure details, pre-existing conditions, property systems, property details, and utility meter numbers. The completeness of multifamily Whole Building data varied substantially between implementers. For example, initially, BayREN was not tracking necessary measure-level details; however, BayREN chose to review past project data to populate a database to facilitate this evaluation. Also, SoCalREN provided the number, quantity, and efficiency of installed measures, but not the location. Recommendations are made to ensure key fields are being adequately tracked.

There were also some issues with the calculation of ex ante lifecycle savings for the RENs in their tracking data. BayREN is calculating lifecycle savings by multiplying the EUL by first year savings, which overestimates lifecycle savings as it does not account for the replacement of the unit after the RUL. SoCalREN, however, appears to be using the correct calculation.

For SoCalREN, there are some single family measures that do not have an applicable code baseline value for the second baseline for cases when the measure is ER. The model should then just assume that the existing baseline is applicable for both baseline values, and they should be set to equal. However, the model appears to be setting the second baseline value to zero, so that the delta wattage is calculated as zero minus the installed wattage, which results in an impact that is equal to the negative value of the annual consumption. Because of this, the lifecycle savings for some measures were extremely highly negative, which had the effect of causing the overall net lifecycle savings for the program to be negative.

Finally, as mentioned above, the RENs' and MCE's tracking data are not in agreement with their 2013-2014 monthly reports. A comparison between the tracking data and the monthly report (2013-2014 inception-to-date fields) showed discrepancies in program expenditures, demand reduction, energy savings, and gas savings. As mentioned earlier, discrepancies varied from 1% up to 87,540%. It was found that the PAs did not always ensure that consistency persisted between annual reports, monthly reports, and tracking data. For example, some costs were included in the annual report, but not in the tracking data.

Overall, the quality of tracking data with respect to cost effectiveness parameters was found to be low. There are many obvious data errors that should be fixed before reporting and submitting to the CPUC. Some quality issues include: program IDs were not always consistent between measure and program data, program IDs were not consistent throughout the 2013-14 program cycle, total costs and incentives were filled in when per unit values were expected, both installation rates and realization rates were set to less than one for a particular claim, many claims reported a NTGR equal to one (which is not an approved ex ante value), and many claims

reported null NTGRs for non-zero savings. In general, data reporting protocols were not followed and as a result low quality program tracking data was produced.

Non-Resource Assessment

The RENs and MCE programs provide a number of services that do not result in direct ex ante energy savings claims, but may very well influence energy efficiency adoptions both within their own programs, in IOU programs, or actions taken outside of an energy efficiency program. Most activities are reported in their annual report and were found to be reasonably reliable, and do not tend to overstate what they have achieved.

An attempt was made to merge a sample of key non-resource tracking databases to IOU ex ante claim databases as a test to see if any IOU program participants were potentially influenced by the non-resource efforts. The number of records that merged to IOU program tracking data was on the order of the number of participants participating in the REN/MCE programs.⁸ Therefore, there is evidence that REN and MCE non-resource activities have the potential to influence IOU participants. The magnitude of this effect could be significant relative to amount of participation occurring in each of the REN and MCE resource programs. However, these activities likely have a negligible effect relative to the amount of participation occurring in the IOU programs that they may be influencing. It is also important to note that a complete assessment of all non-resource efforts was not made. Also, no effort was made to identify what influence these programs have had on adoptions made outside of IOU programs (or intentions to adopt measures), which was outside the scope of this project, but could be another topic for a future evaluation.

This assessment also found that the non-resource databases provided by the RENs and MCE are generally collecting the necessary data to support future evaluations, although the quality, consistency and usability of these data sources varied considerably.

Recommendations are provided that would improve the quality of these tracking data and support future evaluation efforts of these activities, particularly if some form of an attribution assessment was to be performed on measures adopted outside of these PAs' programs.

Overall Conclusion

Overall for MCE small commercial and multifamily measures, ex ante savings values are found to be less than claimed ex ante savings but not much lower than what has been typically found in CPUC evaluations of similar IOU programs. NTGRs are no different than those found for IOU

⁸ For example, 734 single family site IDs in BayREN's Home Upgrade Advisor tracking data merged to PG&E's resource program tracking data. This compares to BayREN's 684 participants in their single family program.

programs, and ex ante claimed data quality will likely be improved over time if recommendations are followed.

For BayREN and SoCalREN multifamily measures, current ex ante savings values are not considered to be reliable based on the ex ante savings review, and the NTGRs for BayREN's multifamily measures are significantly lower than ex ante estimates. Future evaluations can be aided if recommendations are followed, and may help improve the reliability of ex ante savings values.

The RENs and MCE programs also conduct a number of activities that do not result in direct ex ante energy savings claims, but may very well influence energy efficiency adoptions within their own programs, in IOU programs, or on actions taken outside of an energy efficiency program. It is important to consider the benefits that these activities may have when reviewing the program TRCs and PACs presented in this study, especially when comparing to other IOU programs that may be more focused on delivering ex ante resource savings. The magnitude of this effect could be significant relative to the level of participation occurring in each of the REN and MCE resource programs (although negligible relative to statewide IOU program participation levels). It is important to note this was not a comprehensive analysis, and did not attempt to assess the potential influence on intentions or adoptions made outside of any energy efficiency programs.

As the REN and MCE programs are still relatively new, one might expect to see increases in participation, over 2015 and into 2016. This would likely result in an increase in the programs' cost effectiveness if costs do not increase proportionally to the increase in savings. Furthermore, if there was a process available to quantify the benefits that the non-resource activities have had on influencing customers to participate in IOU programs and adopt measures outside of energy efficiency programs, this would also increase the programs' cost effectiveness. It is highly unlikely that the TRC and PAC ratios of the RENs' programs will approach 1.0 given the current values and the values of comparable IOU programs, but increased values might be more acceptable when considering other objectives that these types of programs may be trying to achieve.

As for the MCE programs, it is unlikely that the multifamily program will be cost effective in the near term based on current performance. But, the small commercial program has demonstrated in its 2014 program year that it can be cost effective.

Other important aspects to consider regarding these programs outside of a cost effectiveness metric is the ability to serve hard-to-reach (HTR) customer segments, and the depth of retrofit that is achieved by the programs' installations. All three PAs have a program component that focuses on multifamily customers, which in the past has been identified as an HTR segment. In addition, the MCE small commercial program serves a number of small and very small commercial customers, also an HTR segment. Although these are all important markets to serve,

it is not necessarily unique to the statewide portfolio for programs to be targeting these segments, as there are various IOU programs that also serve HTR markets.

Depth of retrofit metrics are meant to identify programs that are more successful in getting customers to install as many energy efficiency measures as possible and not leave energy efficiency opportunities unaddressed. Programs that focus on just the highest impact measures, in other words, those that have missed energy efficiency opportunities, may have higher resulting TRCs. These higher resulting TRCs arise because these programs only address the most cost effective measures; however they will have a lower depth of retrofit. The Home Upgrade and Multifamily Whole Building programs offered by the RENs offer a whole home/building approach, which results in a high depth of retrofit, but also has the effect of a lower project based cost effectiveness. MCE's small commercial program also delivers a wide array of indoor and outdoor lighting measures and some select refrigeration measures. While, this measure mix is not uncommon, MCE was found to install a fewer number of different types of lighting and non-lighting measures than other similar programs offered in PG&E's territory.

Finally, for the performance of these programs to be accurately assessed, the RENs and MCE need to significantly improve the accuracy and reliability of their reported savings claims and program expenditures. A number of recommendations are made in this study that will hopefully lead to more reliable estimation of ex ante savings claims, and more accurate reporting of key impact and cost parameters; and better support future evaluations of these programs.

1

Introduction

1.1 Goals and Objectives

This document presents the evaluation report for the impact assessment of the energy efficiency programs offered by the 2013-14 Regional Energy Networks (RENs) and Community Choice Aggregator (CCA). The primary goal of this study was to perform an impact assessment on specific measures offered by the RENs and CCA to develop more reliable estimates of program cost effectiveness. It is important to note that a more rigorous ex post impact evaluation is planned for these programs in 2016. Therefore, the objective of this study was to perform a set of quick turnaround tasks that update some key impact parameters using primary data collection (for NTG analysis) and utilizing results from recent gross ex post impact evaluations (for key nonresidential lighting measures), which can be used to develop more reliable estimates of program cost effectiveness. Furthermore, because most of the ex ante claimed savings is associated with measures that do not have recent impact evaluation findings that can be directly applied, a high level assessment of the ex ante savings assumptions, including a comparison between RENs/CCA and investor owned utility (IOU) ex ante impact assumptions was made to identify if there are any obvious over- or understatements of impacts being claimed. Therefore, this study includes the following.

- A high level assessment of the gross ex ante savings values being used for all programs claiming ex ante savings. This includes:
 - Reviewing the ex ante work papers and, for the CCA program, correcting errors in the program tracking databases for the ex ante calculations of deemed measures,
 - Comparing the ex ante assumptions used by the RENs and CCA with those used by the IOUs,
 - Updating gross savings values for selected nonresidential lighting measures for the CCA program based on recent CPUC ex post impact evaluations, and
 - Performing a review of a sample of custom lighting applications for the CCA program and updating gross savings values.
- Development of ex post net-to-gross ratios (NTGRs) for selected measures, and
- Estimation of program cost effectiveness using the updated savings values developed in the gross impact assessment and NTGR analysis described above.

In addition, this study documents accomplishments of the non-resource program components and assesses the ability of the current tracking systems in place for these activities to support future evaluations (i.e., an evaluability assessment). Although no specific attribution of savings is made based on these non-resource accomplishments, this documentation of additional activities that are being conducted by the programs may provide value beyond that which can be measured by the cost effectiveness tests. Future studies may wish to try to better quantify these non-resource accomplishments, which is why an evaluability assessment has been made.

This report includes the evaluation goals and objectives, the researchable issues, information on the programs and measures included in the evaluation, data sources used, the sampling approach, the methods by which these measures are evaluated, results of the analysis, and conclusions and recommendations.

1.2 Overview of 2013-2014 Programs to be Studied

Three PAs (two RENs and one CCA) offer various programs:⁹

- Marin Clean Energy (MCE),¹⁰
- San Francisco Bay Area Regional Energy Network (BayREN),¹¹ and
- Southern California Regional Energy Network (SoCalREN).¹²

Each program administrator (PA) offers a combination of resource programs (those that claim ex ante savings) and non-resource programs. All resource programs are included in the gross savings assessment, while only a subset are covered under the net-to-gross analysis, as described below. The majority of the non-resource programs are included in the evaluability assessment and accomplishments documentation. Note that the Financing program elements and the Codes and Standards related program elements are not included in either assessment as there are

⁹ Subprogram descriptions were taken from Program Implementation plans and were revised based on comments provided by BayREN during the evaluation plan public comment period.

¹⁰ The MCE program implementation plan can be retrieved using the following url:
http://eestats.cpuc.ca.gov/EEGA2010Files/MEA/PIP/2013/Clean/MEA%20PIP_5%207%2013_final.pdf

¹¹ The BayREN program implementation plan can be retrieved using the following url:
http://eestats.cpuc.ca.gov/EEGA2010Files/BayREN/PIP/2013/Clean/A.12-07-001%20Supp%2002_Appendix_A_BayREN_PIP_Revised%20091813%20clean.pdf

¹² The SoCalREN program implementation plan can be retrieved using the following url:
http://eestats.cpuc.ca.gov/EEGA2010Files/SoCalREN/PIP/Clean/2014%2002%2014_Amended%20SoCalREN%20PIP_Clean%20Final.pdf

separate California statewide evaluations being conducted for Financing¹³ and for Codes and Standards.¹⁴

1.2.1 MCE Program Components

MCE's program consists of the following for sub-programs.

- **The MCE Multifamily Program** consists of customized improvements designed to maximize investment in energy efficiency while overcoming the split incentive barrier. The program has been designed to reduce barriers to retrofits by providing technical assistance and incentives to multifamily property owners. MCE promotes these retrofits through targeted outreach and training to property owners and contractors, and makes financing options available through MCE On-Bill Repayment OBR or future Bay Area Regional Energy Network (BayREN) Programs that may include Property Assessed Clean Energy ("PACE") and loan loss reserve. The program also broadens the engagement of stakeholders in messaging and marketing campaigns that factor social and economic co-benefits to customers into the value of energy efficiency upgrades.

This program is included in the gross impact assessment, but is not included in the NTG analysis due to the low number of participants. Any non-resource sub-elements are also included in both the evaluability and the accomplishments assessments.

- **The MCE Small Commercial Program** is a multiple measure program for small commercial high energy use segments which include, but are not limited to, restaurants, retail, and professional services. The Small Commercial Program reduces barriers to retrofits by providing technical assistance and incentives to building owners. MCE promotes these retrofits through targeted outreach and training to property owners and contractors, and will make financing options available through MCE OBR or future BayREN Programs that may include commercial PACE and loan loss reserve.

¹³ The series of impact evaluations that cover financing programs are: Impact Evaluation #1 – Cross-Cutting Background and Attribution Research, Impact Evaluation #2 – Multiphase On-Bill Financing Study, Impact Evaluation #3 – Annual Snapshot and Verification Study, and Impact Evaluation #4 – End of Cycle Studies: 1) ARRA-Originated and Regional Finance Pilots; 2) Statewide Pilots. The studies are cited in the Energy Division and Program Administrator Energy Efficiency Evaluation, Measurement & Verification Plan, Version 5. May 2015.

¹⁴ The Codes and Standards study is the 2013-2014 Codes & Standards Impact Evaluation. The study is cited in the Energy Division and Program Administrator Energy Efficiency Evaluation, Measurement & Verification Plan, Version 5. May 2015.

This program is included in both the gross impact assessment and the NTG analysis. Any non-resource sub-elements are also included in both the evaluability and the accomplishments assessments.

- **The MCE Single Family Program** enables energy and water savings with associated cost reductions through behavior changes, upgrading of appliances, and water conservation measures that affect energy. Funding is primarily for innovative education and outreach programs, web-based action plan tools, and support services. The program includes targeted canvassing and outbound mailer “Energy Reports” to drive participation in the web-based tools and help customers identify key savings opportunities. Additionally, the program supports the MCE finance pilots with targeted marketing and markets other regional programs, including the Pacific Gas & Electric (PG&E) Advanced Home Upgrade California program and the BayREN Home Upgrade program.

This program is included in both the evaluability and the accomplishments assessments.

- **Finance Pilots Program.** MCE is piloting two innovative finance programs to ensure that retrofits are financially competitive and accessible to a broader and more diverse range of property owners for each of MCE’s direct service elements: an On-Bill Repayment (OBR) and a Standard Offer (SO) Energy Efficiency pilots program. The funding is available to help build the OBR and SO frameworks to enable financing of underserved markets. The OBR program allows private banks or financing entities to provide financing to building owners, with the repayment charge placed as a line item on the bill that includes MCE charges. The OBR also includes a credit enhancement for programs to meet the needs of these underserved segments. For Standard Offer, there is no need for capital investment by the property owner. Energy savings will be bid in from an applicant (or implementer) from either customer category. Energy savings will then be paid based on “avoided costs” of energy demand or other energy-related savings.

This program was not evaluated as there is a set of ongoing California Statewide Financing program evaluations being conducted. This study does provide a listing of Financing program non-resource accomplishments that were presented in MCE’s 2014 Annual Report in Appendix B.

1.2.2 BayREN Program Components

BayREN offers four different program elements.

- **The BayREN Single Family Home Upgrade** service is available to owners of single family detached homes in the BayREN territory who are customers of PG&E. BayREN

offers the Home Upgrade program. BayREN does not implement the Advanced Home Upgrade program, but does provide rebate of up to a maximum of \$300 to customers that have completed an Advanced Home Upgrade project with PG&E. PG&E pays the incentive. Participants of the Home Upgrade program choose a minimum of three upgrade measures, each with a predetermined point value. The more points earned, the higher the incentive. Incentives are awarded at \$10 per point, up to a maximum of \$3,000.¹⁵ By lowering logistical costs and overcoming technological and education barriers for participants, as well as by reducing costs for participating contractors through streamlined program design and implementation, Home Upgrade is poised to broaden participation of skilled, specialty contractors and deliver a highly accessible upgrade product to market. Key program elements include the addition of an alternative and multiple upgrade package incentives, enhanced marketing efforts, development of targeted audit incentives (Advanced Home Upgrade available through PG&E only), streamlined enrollment and reporting systems, integration of improvements related to the water-energy nexus, and the implementation of the Home Upgrade Advisor service to support homeowners and contractors through the process.

This program is included in the gross impact assessment, but is not included in the NTG analysis. Any non-resource sub-elements are also included in both the evaluability and the accomplishments assessments.

- **The Bay Area Multifamily Whole Building** service conducts targeted outreach to multifamily property owners to promote participation. It is marketed under Energy Upgrade California[®]. This service allows property owners to receive free technical assistance designed to lower barriers to multiple measure upgrades through technical and financing assistance. Property owners receive customized scopes of work designed to reduce building energy use. Projects with larger scopes of work are referred to the utility whole-building program rebates. Building owners are eligible for a \$750 per unit rebate upon completing the energy efficiency improvements identified in the scope of work.

This program is included in both the gross impact assessment and the NTG analysis. Any non-resource sub-elements are also included in both the evaluability and the accomplishments assessments.

- **The BayREN Codes and Standards Subprogram** consists of three components: enforcement of existing codes, training, and sharing best practices for reach codes. The enforcement effort focuses on establishing a baseline for current code compliance within

¹⁵ In order to offset the cost of the requisite combustion appliance zone (CAZ) test, BayREN began to offer a \$150 rebate to offset the cost of the test beginning in February of 2014.

jurisdictions from each of the nine Bay Area counties, creating metrics for ongoing measurement and identifying mechanisms for improving the current level of compliance. Simultaneously, the program is designed to enhance the enforcement of existing codes through training for local government personnel and building professionals. The menu of training opportunities is targeted to specific functional areas. BayREN intends to work closely with key industry associations, such as the California Building Officials (CalBO), in delivering these trainings and regularly hosts regional forums for local government staff to share and align their enforcement activities.

This sub-program was not evaluated as there is an ongoing California Statewide Code and Standards program evaluation being conducted. This study does provide a listing of this sub program's non-resource accomplishments that were presented in BayREN's 2014 Annual Report in Appendix B.

- **The BayREN Energy Efficiency Financing Portfolio** (the Financing Portfolio) has three programs:
 1. Pay-as-you-SaveTM: BayREN partners with municipal water utilities to design and support the implementation of an on- bill water and energy financing program that allows customers to pay for efficiency improvements on their water bill.
 2. Commercial PACE: BayREN has a limited budget designated for marketing and outreach activities, and has conducted extensive contractor outreach and trainings.
 3. The Multifamily Capital Advance subprogram offers co-financing at zero interest, leveraging an equivalent amount or more of private capital, to help remove the barriers of upfront costs of energy efficiency upgrades to property owners in the hard-to-reach multifamily market.¹⁶

This portfolio was not evaluated as there is an ongoing California Statewide Financing program evaluation being conducted. This study does provide a listing of these program non-resource accomplishments that were presented in BayREN's 2014 Annual Report in Appendix B.

¹⁶ D.12-11-015 deferred consideration of this program to D.13-09-044 regarding the statewide Financing pilots. Consequently, this program's approval was delayed until September, 2013.

1.2.3 SoCalREN Program Components

The SoCalREN offers services in the following three key program areas:

- **Home Upgrade and Multifamily Whole Building Upgrade.** The SoCalREN offers the Home Upgrade and Multifamily Whole Building Upgrade program components to all interested participants in Southern California Edison's (SCE's) and Southern California Gas' (SCG's) service territories. Additional services offered through the SoCalREN pilot are as follows:
 - Local Marketing and Outreach,
 - Green Building Labeling,
 - Single Family and Multifamily Upgrades,
 - Contractor Outreach and Training, and
 - Low-Income Single Family Housing Upgrades.

This suite of programs is included in the gross impact assessment. Any non-resource sub-elements are also included in both the evaluability and the accomplishments assessments.

- **Financing.** The SoCalREN offers financing options to local governments to supplement the on-bill financing offered by the IOUs and, therefore, enable greater investments in deep energy savings. Specific services offered are as follows:
 - Public Building Financing Programs Information and Outreach,
 - Private residential financing Loan Loss Reserve,
 - Nonresidential PACE, and
 - Public Building Revolving Loan Fund Information and Outreach.

This program was not evaluated as there is an ongoing California Statewide Financing program evaluation being conducted. This study does provide a listing of these program non-resource accomplishments that were presented in SoCalREN's 2014 Annual Report in Appendix B.

- **Regional Energy Center.** Building on the current Regional Energy Center which was launched with Flight 5.6 funds,¹⁷ the SoCalREN is offering comprehensive technical support to local governments and other public entities to enable them to implement

¹⁷ Flight 5.6 funds refers to a competitive grant program initiated by Southern California Edison (using ratepayer EE funds) that was a part of their Local Government Partnership program efforts to fund local government actions that were in alignment with and supported the local government-related efforts described in the California Energy Efficiency Strategic Plan.

deeper and more cost effective energy management practices. Specific services include the following:

- An aggregated regional procurement and contracting program,
- Utilization of the Enterprise Energy Management Information System (EEMIS) for integrated and comprehensive energy data management,
- Region-wide building benchmarking and EM&V,
- Support of local Climate Action and Energy Action plans to move to implementation,
- Creation of a water-energy nexus pilot with water utilities,
- Development of a regional energy project tracking and permitting system, and
- Workforce development.

This program is included in both the evaluability and the accomplishments assessments.

Table 1-1 below summarizes the analyses that were conducted for each of the PA’s programs.

Table 1-1: Analyses Conducted for REN and CCA 2013-2014 Programs

PA	Program	Gross Impact Assessment	NTG Analysis	Cost Effectiveness Analysis	Evaluability Assessment	Accomplishments Assessment
BayREN	Single Family Home Upgrade	X		X	X	X
	Multifamily Whole Building	X	X	X	X	X
	Codes and Standards Program					
	Energy Efficiency Financing Portfolio					
SoCalREN	SF Home Upgrade and MF Whole Building	X		X	X	X
	Financing					
	Regional Energy Center				X	X
MCE	Multifamily Program	X		X	X	X
	Small Commercial Program	X	X	X	X	X
	Single Family Program				X	X
	Financing Program					

1.3 Overview of Measures to be Studied

Table 1-2 presents the first year gross ex ante savings values 2013-2014 for each program, by sector and measure group. This summary includes all measures for which there was an ex ante savings claim. The two REN PAs offer the Single Family Home Upgrade and Multifamily Whole Building programs, both of which are whole building retrofit programs with a suite of measures. The MCE program offers a wide variety of energy efficiency measures in both the residential and nonresidential sectors. However, 91% of the MCE program’s claimed electric savings are in the nonresidential sector, and 82% of claimed savings are focused on nonresidential lighting. The MCE’s claimed gas savings are focused on residential faucet aerators and showerheads, which comprise 69% of the total claimed savings.

As mentioned above, all of these measures are included in the gross impact assessment. However, only the BayREN Multifamily Whole Building Retrofit and the MCE Small Commercial measures are included in the NTG analysis.

Table 1-2: Summary of 2013-2014 First Year Gross Ex ante kW, kWh and Therm Savings by Program and Measure Group

PA	Sector	Measure Group	First Year Ex Ante Claimed Savings 2013-2014		
			kW	kWh	Therms
BayREN	Multifamily	Whole building retrofit	198	1,590,268	169.808
BayREN	Single family	Whole building retrofit	289	188,323	49,105
Total			488	1,778,591	218,912
SoCalREN	Multifamily	Whole building retrofit	80	385,255	14,650
SoCalREN	Single family	Whole building retrofit	135	81,014	11,281
Total			215	466,269	25,931
MCE	Multifamily	Building envelope Window film	-	-	19
MCE	Multifamily	Lighting indoor CFL basic	2	24,315	(598)
MCE	Multifamily	Lighting indoor CFL fixture	1	5,807	(35)
MCE	Multifamily	Lighting indoor CFL globe	0	100	(3)
MCE	Multifamily	Lighting indoor linear fluorescent	1	5,662	-
MCE	Multifamily	Lighting outdoor CFL basic	-	16,895	-
MCE	Multifamily	Lighting outdoor LED fixture	-	23,183	-

Table 1-2 (Cont'd): Summary of 2013-2014 First Year Gross Ex ante kW, kWh and Therm Savings by Program and Measure Group

PA	Sector	Measure Group	First Year Ex Ante Claimed Savings 2013-2014		
			kW	kWh	Therms
MCE	Multifamily	Other	0	1,168	1,417
MCE	Multifamily	Pipe insulation hot application	-	-	296
MCE	Multifamily	Water heating faucet aerator	0	194	2,423
MCE	Multifamily	Water heating showerhead	-	-	3,220
MCE	Multifamily	Water heating storage water heater	0	15	753
MCE	Small Commercial	Lighting indoor CFL basic	1	3,028	(22)
MCE	Small Commercial	Lighting indoor CFL other	12	54,811	(365)
MCE	Small Commercial	Lighting indoor occupancy sensor	-	554	(2)
MCE	Small Commercial	Lighting indoor LED fixture	2	9,271	(66)
MCE	Small Commercial	Lighting indoor LED lamp	24	164,447	(1,076)
MCE	Small Commercial	Lighting indoor LED other	8	56,070	(358)
MCE	Small Commercial	Lighting indoor LED reflector lamp	6	26,404	(172)
MCE	Small Commercial	Lighting indoor linear fluorescent	34	116,134	(516)
MCE	Small Commercial	Lighting indoor linear fluorescent delamping	9	28,470	(157)
MCE	Small Commercial	Lighting outdoor CFL basic	-	24,745	-
MCE	Small Commercial	Lighting outdoor LED other	14	229,370	(484)
MCE	Small Commercial	Other	0	640	(3)
MCE	Small Commercial	Refrigeration case LED lighting	4	21,103	(163)
MCE	Small Commercial	Refrigeration door closer	0	3,005	-
MCE	Small Commercial	Refrigeration other	8	57,569	(87)
Total			125	872,920	4,021

2

Overview of Evaluation Approach

This impact assessment of the REN and CCA programs consists of four distinct components, each of which are discussed in detail in this section.

- Assessing the gross ex ante savings values being used, and developing evaluated gross savings values based on this assessment utilizing recent impact evaluation results from relevant studies for key measures,
- Developing ex post net-to-gross ratios (NTGRs) for selected measures,
- Estimating program cost effectiveness using the updated savings values, and
- Documenting the accomplishments that the non-resource components of the programs have had and assessing the ability of the current tracking systems in place for these activities to support future evaluations.

2.1 Gross Ex ante Savings Assessment and Updated Savings Development

Table 1-2 presents the first year gross ex ante savings values for 2013-2014 for each program, by measure group. The programs saw little to no participation in 2013 and were still in the “ramp-up” phase throughout 2014. Because of this, a rigorous impact evaluation was not proposed. Rather, an assessment of the ex ante savings values was conducted. A more detailed impact evaluation is planned for the next evaluation cycle that will include 2015 participation.

2.1.1 MCE Small Commercial and Multifamily Measures

For the MCE programs, there were a variety of residential and nonresidential measures offered. The assessment of these measures included both a review of the ex ante assumptions and a comparison to the IOU values. This task included correcting errors in the program tracking databases for the ex ante calculations of deemed measures, such as applying incorrect DEER parameters, and comparing the corrected ex ante values to the claimed values.

A number of the nonresidential lighting measures were recently evaluated as part of the 2013 Nonresidential Downstream Deemed Efficiency Savings and Performance Incentives (ESPI) Impact Evaluation. This study updated unit energy savings (UES) values for some of the

nonresidential lighting measures offered by MCE. Also, the 2010-12 Nonresidential Downstream Lighting (NRL) Impact Evaluation¹⁸ evaluated additional measures offered by the MCE program. These studies included the following nonresidential lighting measures – compact fluorescent lamps (CFLs), light emitting diode (LED) lamps and reflector lamps, linear fluorescents, high bay linear fluorescents, delamping, high intensity discharge lamps (HIDs) and occupancy sensors. For measures covered under these recent studies, the evaluation results were applied to develop updated savings values.

Although lighting measures comprise 90% of the gross first year claimed savings for MCE's small commercial program, only 12% are deemed indoor lighting measures. Custom lighting measures, however, comprise 78% of the first year claimed gross savings. Because of this, a sample of custom lighting applications was also reviewed and savings values were developed based on this review.

As a result of these activities, savings values were developed for the majority of small commercial measures. For the multifamily measures and the remaining small commercial measures, corrected ex ante values were developed as mentioned above. These evaluated and corrected ex ante values were used to update the cost effectiveness values as described in more detail below.

Note that no new data collection was used for this task.

2.1.2 BayREN and SoCalREN Multifamily Measures

This task consisted of both an assessment of ex ante savings claims, as well as a baseline assessment. The assessment of ex ante savings used three methods to evaluate the reasonableness of savings claims: (1) a review of engineering simulation model assumptions, (2) an engineering desk review, and (3) a consumption analysis.

Each task is described in more depth in the following sections.

Savings Assessment

The evaluation team conducted a high-level assessment of the ex ante savings assumptions, including a comparison between REN and investor-owned utility (IOU) ex ante impact assumptions and potential over- or understatement of impacts being claimed. Each of the three related savings assessment tasks includes the following.

¹⁸ <http://www.energydataweb.com/cpuc/deliverableView.aspx?did=1155&uid=0&tid=0&cid=>

- **Engineering simulation model review.** The goal of this task was to verify that the key input assumptions for similar measures were being recorded and entered into the simulation software in a consistent manner, ensuring comparable energy savings claims where appropriate.
- **Engineering desk review.** The goal of this task was to compare the ex ante savings claims, as calculated by the RENs through simulation models, to savings claims that would have been generated using engineering algorithms for individual measures.
- **Consumption analysis.** The goal of this task was to confirm that modeled savings were proportionate to the actual energy savings of the project.

Baseline Assessment

Typically, two baseline options are used to calculate savings claims for retrofit (existing construction) projects:

- **Early replacement (ER),** whereby the building owner/manager was not planning to upgrade the equipment in absence of the program. This means that the existing equipment could serve as the baseline with an adjusted measure life based on the equipment's expected remaining useful life (RUL).
- **Replace on burnout (ROB),** which can occur either when existing equipment fails or the building owner/manager was already planning to upgrade—by installing new equipment—in absence of the program. In these cases, current codes/standards would serve as the baseline for the entire expected useful life (EUL) of the equipment. The assumption is that the equipment would have been replaced anyway, but the program motivated the decision maker to upgrade from standard efficiency to high efficiency equipment.

The evaluation team used a decision-maker telephone survey to estimate the percentages of ER and ROB participant measures, respectively. The results of this assessment help to inform baseline determinations for both past and future program efforts.

Additionally, the evaluation team reviewed the CPUC tracking databases to assess whether the lifecycle savings correctly accounted for the ER baseline in the REN calculations. Specifically, lifecycle savings for early replacement projects should be calculated using the early replacement baseline for the RUL period, then using a code baseline for the remainder of the EUL, or

$$\text{Lifecycle Savings} = (RUL * Savings_{ER}) + ((EUL - RUL) * Savings_{Code})$$

To do this, the evaluation team recalculated the lifecycle savings using the data provided in the CPUC tracking database and assessed whether this calculation was followed.

2.1.3 BayREN and SoCalREN Single Family Measures

The focus on the gross assessment for the BayREN and SoCalREN single family measures was to analyze and compare savings calculations contained in the PA workpapers with the savings reported in the CPUC claimed savings tracking data. Workpapers were analyzed in order to:

- Assess program documentation quality,
- Assess consistency of assumptions across program administrators,
- Assess measure and package level savings estimates, and
- Assess accuracy of savings claims.

This analysis also identified the critical inputs and assumptions used by each workpaper to estimate baseline energy and how these were adjusted to produce energy savings estimates.

Although there was no initial plan to develop ex post savings values for these single family measures as a result of these analyses, errors were identified in the development of ex ante savings values. These errors were corrected and resulting adjusted ex ante savings values were developed and presented in this study.

2.2 Net-to-Gross Analysis

A net-to-gross (NTG) analysis was conducted for selected measures. For the commercial measures offered under the MCE program, a sample of participants was surveyed by phone to estimate net-to-gross ratios (NTGRs). The survey battery and analysis approach for estimating NTGRs relied on the existing NTGR algorithm used for the 2013 Nonresidential Deemed ESPI Impact Evaluation.¹⁹ The NTGRs developed for the MCE program were compared to the NTGRs developed as part of the 2010-12 Nonresidential Downstream Lighting Impact Evaluation²⁰ for third party programs and the 2013 Nonresidential Deemed ESPI impact evaluation of lighting measures. These are the most recent and relevant studies to be completed, and the algorithm and survey battery are currently being used for the 2014 Nonresidential Deemed ESPI Impact Evaluation.²¹

19 2013 Nonresidential Deemed ESPI Impact Evaluation Final Report:
<http://www.energydataweb.com/cpuc/deliverableView.aspx?did=1253&uid=0&tid=0&cid=>

20 2010-12 Nonresidential Downstream Lighting Impact Evaluation Final Report:
<http://www.energydataweb.com/cpuc/deliverableView.aspx?did=1155&uid=0&tid=0&cid=>

21 2014 Nonresidential Deemed ESPI Impact Evaluation Research Plan:
http://www.energydataweb.com/cpucFiles/pdaDocs/1210/PY2013-2014%20Deemed%20ESPI%20Research%20Plan_PDA.pdf

Similarly, a sample of BayREN multifamily Whole Building program participants were surveyed to estimate NTGRs. The survey battery and analysis approach for estimating NTGRs relied on the existing approach and survey instrument that was developed for the 2013-2014 statewide multifamily evaluation that is currently being conducted.²²

NTGR analysis was not conducted for any single family Home Upgrade whole building retrofit suite of measures as there is no existing approach that has been utilized by the statewide single family study. Furthermore, because of the small number of participants in MCE's multifamily program and in the SoCalREN multifamily Whole Building program, a NTGR analysis was not conducted. With only two unique customers in SoCalREN's multifamily program and only nine in MCE's multifamily program, a reliable estimate of the NTGR could not be developed.

2.3 Cost Effectiveness Analysis

Utilizing the evaluated results from the gross and NTG analyses, revised cost effectiveness metrics were developed for each of the programs evaluated. The results were compared to those based solely on claimed ex ante savings values. Finally, a comparison was made to a variety of IOU programs that are considered to have some similarities in program delivery and measures offered.

2.4 Non-Resource Program Component Assessment

This task consists of two activities: documenting the accomplishments of the non-resource program components and assessing the ability of the current tracking systems in place for these activities to support future evaluations. In addition, merges to IOU tracking data were conducted using a selected set of databases provided by the RENs and CCA to gauge how effectively non-resource program activities have led to participation in PA resource programs.

The purpose of documenting the accomplishments of the non-resource program components is to identify the value these programs might have provided beyond the ex ante energy savings claims they have made. The PAs have documented a number of accomplishments in their Annual Reports. This includes various activities, such as local outreach, contractor outreach and training, green building labeling, financing, technical assistance and others. The evaluation team worked with the PAs to identify other accomplishments not already documented in their Annual Reports as well. In addition, the team also examined their participant tracking records and summarized any activities that are being recorded in those databases.

The purpose of the tracking system assessment was to determine if the PAs have collected sufficient data on customers and contractors that participate in their non-resource activities, such

²² The CPUC multifamily evaluation study being conducted is 2013-2014 Multifamily Focused Impact Evaluation.

that a future evaluation could be conducted. For example, the evaluation team investigated if contact information is available so customers and contractors participating in the various activities (such as those mentioned above) can be interviewed. The databases were also investigated to see if they contained data fields, such as account numbers or service addresses, such that records can be merged to IOU program tracking data to determine if the non-resource program participants have gone on to participate in IOU programs. For a select number of non-resource activities, merges of the related datasets to IOU program tracking data were attempted to determine if any of non-resource program participants have gone on to participate in IOU programs. Finally, the quality of the data being recorded was assessed to determine how often key fields are missing or contain unusable data. As a result of this assessment, recommendations were made on how to improve the quality of the tracking databases so that future evaluation work can be performed.

Although no new data collection was required for this activity, it required a substantial amount of coordination with the PAs to obtain and assess their tracking data.

3

Data Sources and Sample Design

This section of the report outlines key primary and secondary sources of information that were used to support the research activities of this evaluation, which included the following:

- Resource and non-resource program tracking data
- Decision-maker survey,
- Calculated measure applications and calculation workbooks,
- REN and IOU simulation models,
- The Database for Energy Efficiency Resources (DEER),
- Utility workpapers, and
- Utility Customer Information System (CIS) energy consumption (billing) data.

In addition, the team used previously vetted analysis methods, such as the CPUC Energy Division’s Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers²³ (referred to hereafter as the “framework”). This ensures consistency across evaluations, allows comparisons between programs, and ensures that the survey batteries have been properly vetted. Both the free ridership (FR) and early replacement (ER) batteries have been customized to the unique characteristics of the RENs.

3.1 Key Data Sources

This section outlines the primary and secondary data sources the evaluation team used in the impact assessment tasks.

3.1.1 Resource and Non-resource Program Tracking Data

Program tracking data were utilized from each of the PAs for all of their programs. For the resource program elements, these databases served as the source of the ex ante claimed savings,

²³ Energy Division, CPUC. Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers. Prepared by the Nonresidential Net-To-Gross Ratio Working Group. October 16, 2012.

and the NTG sample was drawn from these data. Although the evaluation focused on 2013-14, participants in the first half of 2015 were also included in the NTGR sample to increase the sample frame population so more surveys could be completed.

Furthermore, program tracking data corresponding to all non-resource activities were also obtained to support the non-resource assessment. This allowed for the verification of non-resource accomplishments and an evaluability assessment of the tracking data to be performed.

3.1.2 NTGR and REN Baseline Participant Phone Surveys

This study implemented a phone survey of commercial MCE and multifamily Whole Building BayREN customers to support the NTG analysis. The participant populations for the MCE commercial and BayREN multifamily programs are limited, so a census was attempted. Table 3-1 summarizes participation by Program Administrator and program for these program elements, presenting the ex ante savings values for 2013-14 along with the number of applications contained in the tracking data, the targeted sample size, the number of completed phone surveys, and the percentage of the first year ex ante claimed savings that the completed phone survey sample represents.

Table 3-1: NTGR Phone Survey Completes by Program Administrator and Program

PA	Program	First Year Ex Ante Claimed Savings			Number of Applicants	Target Sample	Completed Surveys	% of kWh Completed
		kW	kWh	Therms				
BayREN	Multifamily	198	1,590,268	169,807	125	20	43	47%
MCE	Small Commercial	121	795,622	(3,471)	84	20	20	23%

For both surveys, customers were surveyed via telephone interviews, by seasoned interviewers who could schedule and adjust telephone appointments, make additional phone calls to talk with multiple decision makers (as necessary or when recommended by the primary contact), and had ample time to complete the interviews.

The REN multifamily participant survey was also used to support the baseline review portion of the impact assessment. The REN multifamily survey targeted property managers, owners, or other primary decision makers involved in executing the program at the property level, whereas

the MCE small commercial survey targeted participating customers.²⁴ Contacts for these surveys were derived from the program tracking databases. Survey topics included the following:

- Confirmation/verification of installed measures,
- Anticipated actions in absence of program intervention,
- Importance of program education and incentives on the decision to install high efficiency equipment,
- Working status and estimated age of replaced units, and
- Timing for building maintenance/upgrades.

For the multifamily survey, past evaluations have found that property owners and managers are challenging to contact. To increase the response rate, the evaluation team worked with the RENs to send notifications to participant contacts to inform them that the survey was pending and to encourage them to participate. As shown in Table 3-1, this effort resulted in a very high response rate. Of the 92 property owners representing 125 project applications in the 2013–2015 REN multifamily programs, the evaluation team completed surveys with 43 respondents.²⁵ Projects where contact information was not provided by the RENs were excluded from the telephone survey efforts.²⁶

3.2 Additional Data Sources Supporting the MCE Assessment

3.2.1 Calculated Applications

To support the development of the updated savings values for calculated indoor lighting projects rebated under MCE's Small Commercial Program, applications and supporting calculation workbooks were obtained for a sample of projects. These calculation workbooks detail each of the impact parameters that were used to develop the site-specific ex ante gross savings that are documented in the tracking data.

²⁴ The REN multifamily programs target whole building multifamily retrofits that are conducted and implemented by the property owner. As such, these surveys did not target the tenant population because they were not assumed to be part of the decision-making process.

²⁵ In cases where a single property owner has more than one property participating in the REN program, the interviewer first completed the survey on a single property, then conducted the survey on a second or third property record.

²⁶ In instances where there was a participant address, but no telephone information, the evaluation team mailed a recruitment letter (with a callback phone number to complete the survey), in hopes that the participant would call the research firm and take the survey. This occurred in seven of the 125 applications, or 6%.

3.3 Additional Data Sources Supporting the Multifamily REN Assessment

The engineering simulation model review, engineering desk review, and consumption analysis relied on a wide variety of data sources to compile a complete picture of the reliability of savings claims. The evaluation team required a number of sources because comprehensive multifamily projects are often large in scope and experience high tenant turnover. In addition, program databases often have only limited details on pre-existing and installed measures. These characteristics require more complex analysis than traditional measure-level incentive programs.

3.3.1 Engineering Simulation Model Review

The RENs and IOUs both use the EnergyPro building simulation software²⁷ to estimate measure impacts associated with the multifamily Whole Building program. The evaluation team's primary goal with the model review task was to understand the similarities and differences between the BayREN and SoCalREN inputs and assumptions and the IOU models, and ensure that there were no significant differences that could result in inconsistent model use. Using the models inconsistently could ultimately affect the energy savings estimates resulting from the models. PG&E, San Diego Gas & Electric (SDG&E), SCE, and SCG all offered comprehensive multifamily programs in 2013 and 2014, similar to the REN programs. The SDG&E projects were chosen (over the other California IOUs) to compare with the REN programs because SDG&E had full measure-level data and had completed Multifamily Whole Building projects in the 2013–2014 program cycle.

To accomplish the model review task, the team used three data sources and two distinct sets of interviews. The data sources included (1) the tracking database from each REN and from SDG&E; (2) the EnergyPro building simulation files; and, if available, (3) any supplemental (external to EnergyPro) project calculation files provided by the RENs and SDG&E. The interviews included (1) discussions with evaluation team engineers who were familiar with the EnergyPro model and (2) in-depth interviews with three independent staff members responsible for either running or reviewing the EnergyPro models for the two RENs and for SDG&E.

The evaluation team covered the following topics during the interviews.

- Who enters the building data? Who is in charge of calculating savings both within and outside the EnergyPro Software?
- Does anyone with your organization or outside of your organization review the model inputs?

²⁷ Please see <http://www.energysoft.com/> for additional model details.

- If contractors are using this, how are they trained? Do they follow standard practices, and if so, what are those practices? Do they have standard certifications? Is there a guidebook or handbook on your internal EnergyPro standard inputs or practices?
- What happens to savings estimates from the models? Are they shared with your group for review?
- Do the contractors or your team also develop or use other models or spreadsheets outside the EnergyPro software for other measures (which might include appliances, lighting, and small water heating measures such as showers and faucets)? Are all measures input into the model, or are some calculated outside the model?
- If calculated outside the model, what programs are used?
- Do other entities use these external programs, or just your organization?
- What baseline assumptions are used (ROB [code] versus ER)? How do contractors make this distinction?
- Do you use the residential model, commercial model, or some combination of the two?
- Do you use actual billing data to calibrate to actual building consumption?

3.3.2 Engineering Desk Review

The evaluation team chose six projects for the engineering desk review. The projects were stratified and chosen based on relative contributions of savings (in kBtu, to combine electric and gas savings) to the total program portfolio. The evaluation team chose two high-savings projects, two mid-level savings projects, and two small/low-level savings projects. In this manner, the evaluation team could determine if the models more closely matched engineering savings based on their size. Table 3-2 illustrates the projects evaluated during the engineering desk review and the associated ex ante savings. In total, these projects represented approximately 21% of the claimed savings for the combined BayREN and SoCalREN projects, with the top two projects representing 11.3% and 8.7% of savings, respectively.

Table 3-2: Engineering Desk Review Evaluated Sample, By Project

Project Number	REN	Ex Ante kBtu	Type
Project 1	BayREN	2,856,337	High Savings
Project 2	SoCalREN	2,192,862	High Savings
Project 3	BayREN	133,014	Mid-Level Savings
Project 4	BayREN	122,192	Mid-Level Savings
Project 5	BayREN	11,391	Low Savings
Project 6	BayREN	9,135	Low Savings

The six projects included a variety of energy efficiency savings measures, including attic, roof, and pipe insulation; dishwashers; heat pumps; faucet aerators; CFL and LED lamps; lighting controls; low-flow showerheads; pool covers, heaters, and pumps; refrigerators; space heating systems; water heaters and water heating controls; windows; and vending machines.

For this review, the evaluation team relied on the quantity and details of each installed measure provided by the RENs in their backup documentation. The team performed an in-depth review of the test-in and test-out documents, savings calculations, EnergyPro models, measure-level savings databases, CPUC tracking data, and initial survey assessments. This review allowed the team to extract pertinent information on the projects and installed measures, including the following:

- Quantity of tenant units,
- Location, efficiency, size, and quantity of installed measures, and
- Climate zone.

In addition, results from the baseline assessment fed into measure-level savings estimates when the savings estimates or calculations differentiated between these baseline types. For example, DEER provides separate savings estimates for ER and ROB baseline conditions. The team's baseline assessment showed that most REN multifamily insulation measures were classified as ER. As a result, the measure-level savings used the ER per unit savings values.

The evaluation team relied on the 2013–2014 DEER, the 2013 ESPI Performance Statement Report,²⁸ the IL TRM v4.0,²⁹ utility evaluations and work papers, and U.S. Department of Energy (DOE) guidelines³⁰ for the evaluated savings estimates and algorithms. DEER savings estimates were the first choice for savings estimates because they represent California-specific weather and usage conditions. When an installed measure was not present in the DEER database, however, the team used secondary sources. In a few instances, such as pool heaters and hot water pipe insulation, the evaluation team relied on savings calculations provided by the implementer because the algorithms and savings were deemed sufficient for this purpose. Table 3-3 presents evaluated measures and sources for savings estimates.

²⁸ CPUC. 2013 Ex post Efficiency Savings and Performance Incentive (ESPI) Performance Statement Report and supporting documents. August 2015.

²⁹ IL TRM. Version 4.0. January 23, 2015; Navigant Consulting, Inc. Home Energy Efficiency Rebate Program. GPY2 Evaluation Report. February 27, 2014; and The Cadmus Group, Inc. 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to Gross, Market Effects, and Equipment Replacement Timing. Volume 1. Part of the Massachusetts Residential Retrofit and Low Income Program Area Evaluation. June 2013.

³⁰ DOE. Measure Guideline: Replacing Single-Speed Pool Pumps with Variable Speed Pumps for Energy Savings. May 2012.

Table 3-3: Engineering Desk Review Project Measures and Savings Sources

Measure	Savings Source
Attic/Roof Insulation	DEER
Hot Water Demand Controls	IL TRM
Hot Water Pipe Insulation	BayREN Savings Calculations
Dishwasher	DEER
Ductless Heat Pump	DEER
Faucet Aerator	ESPI Report
CFLs and Fixtures	DEER
LED Bulbs and Fixtures	DEER (adjusted) ¹
Lighting Controls	DEER
Low-Flow Showerheads	ESPI Report
Pool Covers	Work-Paper Disposition ²
Pool Heaters	BayREN Savings Calculations
Pool Pumps	DOE Guidelines
Refrigerators	DEER
Space Heating Boilers	DEER
Storage Water Heaters	DEER
Vending Machines	IL TRM
Water Heating Boiler Controls	DEER
Water Heating Boilers	IL TRM
Windows	Northwest Energy Efficiency Alliance (NEEA) Evaluation ³

¹ DEER values were adjusted to account for LED wattage.

² CPUC, Energy Division. Work-Paper Disposition for Commercial Pool Covers. March 1, 2013.

³ Navigant Consulting, Inc. Long-Term Monitoring and Tracking Report on 2011 Activities. Prepared for NEEA. July 23, 2012.

3.3.3 Consumption Analysis

One of the challenges associated with performing a consumption analysis on multifamily properties is the availability of gas and electric account numbers at the tenant and common area levels. Because the REN multifamily programs are comprehensive, a consumption analysis is successful only if the evaluation team can access consumption information for the entire project, including all tenant and common areas in the buildings. This consumption analysis was dependent, then, on REN program implementers supplying gas and electric account numbers for the tenant and common areas for participant projects. Both SoCalREN and BayREN furnished the participant account numbers they had collected; however, these account numbers captured only a fraction of the participant units (details are discussed in Section 4).

The evaluation team conducted two types of searches to capture consumption data for the participant properties: account number matching and address matching. These two methods were an attempt to capture the most comprehensive consumption data on the participant projects. Details about each of the matching approaches follow.

- 1) Matches by account number(s) allow the extraction of electric and gas consumption data from the REN-provided unit- and building-level account numbers. If the account numbers are not accurate or present, though, this match will be unsuccessful.
- 2) Matches by address allow extraction of all the consumption data for the address that is available based on the street addresses provided by the RENs. If associated units have a different street address, though, they will not be captured (e.g., “996 Main St.” in the database will not match “998 Main St.” in the consumption data, even if they are two units in the same building).

3.4 Additional Data Sources Supporting the Single Family REN Assessment

3.4.1 Workpapers

The workpapers provide the assumptions and critical inputs used to estimate energy savings values. Critical inputs include dwelling size in total square feet, construction vintage, and location in terms of California Energy Commission climate zones. Some inputs are used to identify appropriate DEER deemed savings and some are used to calculate scaling factors.

REN workpapers were never officially approved by the CPUC. Consequently, the workpaper assumptions changed with each refinement made to the program, and, as a result, multiple methodologies were used to estimate savings at various points during the programs operation. The workpapers used in this analysis included:

- SCE - Workpaper SCE13MI005, Revision 0 (Feb. 27, 2012),
- Energy Upgrade California® (EUCA) Calculator Version 10,
- EUCA Calculator Version 11, and
- Work Paper SCE13MI005 Revision 2, which produced EUCA Phase 2 WP Calc Tool V3.

The EUCA calculator was developed and built by PECI (now CLEAResult). PECI explains the model’s calculations this way,

The calculator estimates the energy savings that will result from home upgrade packages completed under the [Home Upgrade] program. It is built on eQuest simulations of energy saving measures and packages of measures using DEER single family home prototypes.³¹ Those simulations produced the ModeledResults_DB. It wasn't possible to simulate every possible combination of measures, so this calculator was created to accommodate measure package combinations not included in the simulations. The calculator takes one Core Measure or Package and adds or subtracts up to three individual measures. It is not a simple addition or subtraction, because the measures have interactions. When an individual measure is added, that measure's energy savings is first reduced by the percentage savings achieved in the package that the measure is being added to. This reconciliation is done on an end use basis. For example, if an efficient AC that saves 25 kWh of cooling energy is added to a package that has already saved 10% of the home's cooling energy, then only 22.5 kWh savings would be added to the package.

The workpapers and calculators base all measure combination savings on three modeled³² home vintages: pre-1978, 1978-1992, and 1993-2001.

The final PG&E workpaper used in this review was PGECOALL108, Home Upgrade Program, Revision #0, Sept. 30, 2013.

For SCE, the evaluation team used SCE13MI005, Basic Path Enhancement for the Whole House Upgrade Program, Feb. 27, 2012.³³

³¹ These are developed using findings from the Residential Appliance Saturation Survey (RASS) data collected by the California Energy Commission.

³² The model used depends on the source document. Workpapers cite Energy Pro. EUCA cites eQuest.

³³ Extracted from the Workpaper Archive at www.deeresources.info

4

Gross Assessment

This section presents the detailed approach to conduct the gross assessment, along with the findings from those analyses. This section reports separately the MCE small commercial and multifamily measures, the REN multifamily measures and the REN single family measures. Finally, an integration section of conclusions and recommendations is provided.

4.1 MCE Small Commercial and Multifamily Measures

This section discusses the various analysis methods and results for the gross savings assessment for the MCE small commercial and multifamily measures. Three separate analyses were conducted as described in detail below.

- A review of the ex ante savings values for all MCE small commercial and multifamily measures, which resulted in correcting a number of values in the tracking data that did not line up with the workpapers.
- The development of evaluation savings values for a number of deemed lighting measures offered under MCE's Small Commercial program, which were based on results from recent CPUC evaluations.
- The development of evaluation savings values for a number of calculated lighting projects rebated under MCE's Small Commercial program, which were based on a desk review of a sample of project applications and documentation and utilized results from recent CPUC evaluations.

4.1.1 Ex Ante Review of Deemed Measures

Overview

The objective of this task was to determine if the ex ante savings provided in MCE's tracking data and associated with deemed measures were reported correctly according to documented ex ante assumptions. This activity included a review of each individual line item in MCE's tracking data for small commercial and multifamily deemed measures. Each impact parameter for each line item was compared to the values documented in the DEER and/or PG&E's workpapers. Whenever discrepancies were identified, the impact parameters were updated with the correct

value. Savings values were then re-computed with the correct impact parameter values, and measure group and program level aggregated savings values were developed, as reported below.

Approach and Findings

The ex ante review of deemed measures was based on program tracking data submitted June 2015, which contained all claims for the 2013-2014 program years, including lighting claims that refer to the updated Lighting Disposition values. The parameters reviewed include:

- Unit Energy Savings (first and second baselines if applicable),
- Realization rates,
- Installation rates,
- Remaining Useful Life (if applicable),
- Effective Useful Life, and
- Net-to-Gross ratios.

As stated above, the listed ex ante parameters were reviewed and compared against DEER or an applicable workpaper for each claim. One major hurdle encountered was the difficulty of easily tracking the source of ex ante assumptions. Although there were some measure IDs given, critical information was not referenced, such as net-to-gross IDs or whether the ex ante source is from the DEER or an IOU workpaper. This lack of proper references proved difficult for the review of ex ante assumptions. Regardless, from the measure descriptions in conjunction with the READI tool,³⁴ workpaper documentation, and supplemental information from the tracking data, the reviewers were able to find ex ante documentation for each deemed measure line item in MCE's tracking data.

Results

Through this effort, it was found that approximately two-thirds of the energy savings for the multifamily program and all of the energy savings from the small commercial program needed at least one update to an impact parameter. Table 4-1 through Table 4-3 compares the corrected reviewed savings values to the ex ante reported savings values for all of MCE's deemed measures. Reported savings come directly from the PA's program tracking data submitted to the CPUC. Each table contains the first year and lifecycle savings values and realizations rates grouped by program and measure group.

³⁴ <http://www.deeresources.com/index.php/deer-versions/readi>

Table 4-1: Comparison Between Reported Versus Reviewed First Year and Lifecycle kW Savings with Gross Realization Rates – Deemed Measures Only

Program Name	Measure Group	First Year kW			Life Cycle kW		
		Reported	Reviewed	GRR	Reported	Reviewed	GRR
Multifamily	Lighting indoor CFL basic	2.19	2.18	100%	24.04	21.05	88%
Multifamily	Lighting indoor CFL fixture	1.22	0.77	63%	13.46	2.53	19%
Multifamily	Lighting indoor CFL globe	0.01	0.01	99%	0.10	0.08	87%
Multifamily	Lighting outdoor CFL basic	-	-		-	-	
Multifamily	Other	0.15	0.15	97%	2.30	2.23	97%
Multifamily	Water heating faucet aerator	0.01	0.01	99%	0.15	0.15	99%
Multifamily	Water heating showerhead	-	-		-	-	
Multifamily	Water heating storage water heater	0.01	-	0%	0.13	-	0%
Small Commercial	Lighting indoor CFL basic	0.62	0.55	89%	6.83	6.63	97%
Small Commercial	Lighting indoor LED fixture	1.90	1.89	100%	22.77	22.74	100%
Small Commercial	Lighting indoor LED lamp	5.70	8.17	143%	68.45	48.47	71%
Small Commercial	Lighting indoor LED reflector lamp	5.57	6.28	113%	64.24	36.01	56%
Small Commercial	Lighting indoor linear fluorescent delamping	9.16	0.78	8%	70.17	12.41	18%
Small Commercial	Other	0.20	0.20	100%	2.40	1.60	67%
Small Commercial	Refrigeration door closer	0.32	0.32	100%	2.58	2.58	100%
Small Commercial	Refrigeration other	7.72	7.72	100%	80.66	69.59	86%
MCE Total		34.78	29.03	83%	358.28	226.06	63%

Table 4-2: Comparison Between Reported Versus Reviewed First Year and Lifecycle kWh Savings with Gross Realization Rates – Deemed Measures Only

Program Name	Measure Group	First Year kWh			Life Cycle kWh		
		Reported	Reviewed	GRR	Reported	Reviewed	GRR
Multifamily	Lighting indoor CFL basic	24,315	23,841	98%	267,464	230,544	86%
Multifamily	Lighting indoor CFL fixture	5,807	3,658	63%	63,873	12,020	19%
Multifamily	Lighting indoor CFL globe	100	101	101%	1,104	976	88%
Multifamily	Lighting outdoor CFL basic	16,895	16,895	100%	50,893	50,893	100%
Multifamily	Other	1,168	1,370	117%	17,664	20,695	117%
Multifamily	Water heating faucet aerator	194	192	99%	1,939	1,924	99%
Multifamily	Water heating showerhead	-	-		-	-	
Multifamily	Water heating storage water heater	15	-	0%	302	-	0%
Small Commercial	Lighting indoor CFL basic	3,028	2,691	89%	33,311	32,297	97%
Small Commercial	Lighting indoor LED fixture	9,271	9,292	100%	111,253	111,509	100%
Small Commercial	Lighting indoor LED lamp	26,459	38,151	144%	317,502	224,055	71%
Small Commercial	Lighting indoor LED reflector lamp	26,404	29,834	113%	304,139	168,892	56%
Small Commercial	Lighting indoor linear fluorescent delamping	28,470	2,441	9%	218,080	39,055	18%
Small Commercial	Other	640	640	100%	7,680	5,120	67%
Small Commercial	Refrigeration door closer	3,005	3,005	100%	24,038	24,040	100%
Small Commercial	Refrigeration other	57,569	57,518	100%	596,488	519,060	87%
MCE Total		203,339	189,629	93%	2,015,731	1,441,080	71%

Table 4-3: Comparison Between Reported Versus Reviewed First Year and Lifecycle Therm Savings with Gross Realization Rates – Deemed Measures Only

Program Name	Measure Group	First Year Therms			Life Cycle Therms		
		Reported	Reviewed	GRR	Reported	Reviewed	GRR
Multifamily	Lighting indoor CFL basic	(598)	(579)	97%	(6,576)	(5,595)	85%
Multifamily	Lighting indoor CFL fixture	(35)	(22)	63%	(385)	(72)	19%
Multifamily	Lighting indoor CFL globe	(3)	(2)	95%	(28)	(24)	84%
Multifamily	Lighting outdoor CFL basic	-	-		-	-	
Multifamily	Other	1,417	1,176	83%	21,638	18,028	83%
Multifamily	Water heating faucet aerator	2,423	2,405	99%	24,226	24,045	99%
Multifamily	Water heating showerhead	3,220	3,207	100%	32,199	32,068	100%
Multifamily	Water heating storage water heater	753	361	48%	15,053	5,414	36%
Small Commercial	Lighting indoor CFL basic	(22)	(18)	85%	(237)	(220)	93%
Small Commercial	Lighting indoor LED fixture	(66)	(61)	94%	(789)	(738)	94%
Small Commercial	Lighting indoor LED lamp	(170)	(220)	129%	(2,039)	(1,316)	65%
Small Commercial	Lighting indoor LED reflector lamp	(172)	(184)	107%	(1,942)	(1,060)	55%
Small Commercial	Lighting indoor linear fluorescent delamping	(157)	(13)	8%	(1,206)	(212)	18%
Small Commercial	Other	(3)	(3)	100%	(36)	(24)	67%
Small Commercial	Refrigeration door closer	-	-		-	-	
Small Commercial	Refrigeration other	(87)	(87)	100%	(1,042)	(1,040)	100%
MCE Electric Subtotal		(1,312)	(1,190)	91%	(14,280)	(10,300)	72%
MCE Gas Subtotal		7,812	7,148	92%	93,116	79,556	85%
MCE Total		6,500	5,959	92%	78,836	69,256	88%

The main reason for discrepancies when comparing to the ex ante savings likely stems from reporting errors. The reason for measure groups with small discrepancies is usually due to small rounding errors in ex ante parameters or a mismatch in building types. For measure groups with larger discrepancies, it was found that improper references were being made to ex ante assumptions. In the case of the delamping measure group, a low realization rate was calculated due to a major difference in UES savings values. Further, there were claims for the exact same measure code, same measure name, same building type, and same climate zone yet there were drastically different UES values for each claim. Given the same ex ante categorizations one should expect the same ex ante assumptions. These types of inconsistencies were found throughout the data to varying degrees. Updates to the EUL parameter also played a large role for kW and kWh lifecycle realization rates. The largest impact of this update was found to be in the refrigeration other, LED lamp, and LED reflector lamp measure groups. The largest discrepancies occurred for claims with reported EULs of 12, whereas the ex ante review found the correct EULs to be between 4 and 9.

4.1.2 Evaluation Update of Deemed MCE Commercial Lighting Measures

Overview

The objective of this task was to develop evaluation savings values for key indoor lighting measures offered under MCE's Small Commercial program. To do so, various results were utilized from two recent CPUC evaluations: the 2013 Nonresidential Downstream Deemed ESPI Impact Evaluation, and the 2010-12 Nonresidential Downstream Lighting (NRL) Impact Evaluation. The following nonresidential indoor lighting measures were evaluated under these studies – CFLs, LED lamps and reflector lamps, linear fluorescents, high bay linear fluorescents, delamping, HIDs and occupancy sensors. The approach used to develop these evaluated savings values and the results of this analysis are presented below.

Approach and Findings

The nonresidential studies from 2010-12 and 2013 provided robust results that are directly applicable to measures claimed by MCE. Applicable results were provided for MCE's deemed CFLs, LED lamps and reflector lamps, and delamping measures. These results updated approximately two-thirds of the demand reduction and more than half of the energy savings claimed through MCE's small commercial deemed measures. In particular, updates were provided for the following gross impact parameters:

- Unit Energy Savings (first and second baselines where applicable),
- Installation rates,
- Remaining Useful Life (where applicable), and
- Effective Useful Life.

To apply results, a decision was made for each claim to determine which specific evaluation results to utilize. The measure name, measure code, and building type information from the tracking data was used to determine which set of results to apply. These fields were populated reasonably well, allowing for the assignment of a proper evaluation result. However, much improvement can be made in populating these fields. Specifically, proper references to ex ante documentation should be included in the tracking data. These references provide insight to critical information such as baselines assumed, operating hours, and sector applicability. This supplemental information would have provided background to further ensure proper application of evaluation results. On a related note, MCE should avoid using the “Com” building type whenever possible as this is not descriptive and limits the depth of evaluation results. MCE should make extra efforts to fill in building types with proper classifications, though it is understood that this cannot always be done. Another opportunity for improvement is in the measure description and measure code fields. There were some claims that did not include measure codes and/or had measure descriptions lacking detail. A descriptive measure name and valid measure code supply critical information related to baseline and retrofit assumptions. Overall, information provided in the tracking data was sufficient enough to apply proper evaluation results.

Results

Table 4-4 and Table 4-5 present results of the reported claimed savings versus evaluation results where parameter updates were applied. Each table contains the first year and lifecycle savings values and realizations rates grouped by program and measure group.

Table 4-4: Comparison Between Reported Versus Evaluated First Year and Lifecycle kW Savings with Gross Realization Rates – Deemed Measures Only

Program Name	Measure Group	First Year kW			Life Cycle kW		
		Reported	Evaluated	GRR	Reported	Evaluated	GRR
Small Commercial	Lighting indoor CFL basic	0.62	0.26	43%	6.83	2.24	33%
Small Commercial	Lighting indoor LED lamp	5.70	4.05	71%	68.45	58.57	86%
Small Commercial	Lighting indoor LED reflector lamp	5.57	9.39	169%	64.24	58.40	91%
Small Commercial	Lighting indoor linear fluorescent delamping	9.16	1.84	20%	70.17	15.31	22%
MCE Total		1.05	15.55	74%	209.68	134.53	64%

Table 4-5: Comparison Between Reported Versus Evaluated First Year and Lifecycle kWh Savings with Gross Realization Rates – Deemed Measures Only

Program Name	Measure Group	First Year kWh			Life Cycle kWh		
		Reported	Evaluated	GRR	Reported	Evaluated	GRR
Small Commercial	Lighting indoor CFL basic	3,028	1,405	46%	33,311	11,932	36%
Small Commercial	Lighting indoor LED lamp	26,459	16,482	62%	317,502	237,522	75%
Small Commercial	Lighting indoor LED reflector lamp	26,404	38,678	146%	304,139	240,578	79%
Small Commercial	Lighting indoor linear fluorescent delamping	28,470	7,291	26%	218,080	60,694	28%
MCE Total		84,361	63,857	76%	873,032	550,726	63%

The main reasons for discrepancies is due to differences in UES values for first year gross realizations rates and EUL values for life cycle realization rates. Installation rates played a small factor in the discrepancies and were relatively consistent when comparing evaluation installation rates to reported installation rates. For all measure groups, with the exception of LED reflector lamps, UES values were overstated in the tracking data when compared to evaluation results. For LED reflector lamps and CFL basics, EUL values were overstated in comparison to evaluation results. Ex ante documentation was not readily available due to the absence of references. This documentation could have shown the details into why discrepancies exist, particularly in wattage, coincidence factor, and operating hour assumptions. For the measures evaluated, delamping had the lowest realization rates. This result is consistent with the ex ante review of deemed measures discussed in section 4.1.1. This finding reveals an opportunity of improvement for MCE related to the process of claiming savings (e.g., proper references, correct values, quality control checks).

Further analysis determined what realization rates would have been if MCE had used the corrected deemed values found in the ex ante review as discussed in section 4.1.1. Table 4-6 and Table 4-7 present results of the claimed savings updated with values from the ex ante review versus evaluation results. Each table contains the first year and lifecycle savings values and realizations rates grouped by program and measure group for the deemed measures updated though evaluation results.

Table 4-6: Comparison Between Ex Ante Reviewed Versus Evaluated First Year and Lifecycle kW Savings With Gross Realization Rates – Deemed Measures Only

Program Name	Measure Group	First Year kW			Life Cycle kW		
		Reviewed	Evaluated	GRR	Reviewed	Evaluated	GRR
Small Commercial	Lighting indoor CFL basic	0.55	0.26	48%	6.63	2.24	34%
Small Commercial	Lighting indoor LED lamp	8.17	4.05	50%	48.47	58.57	121%
Small Commercial	Lighting indoor LED reflector lamp	6.28	9.39	150%	36.01	58.40	162%
Small Commercial	Lighting indoor linear fluorescent delamping	0.78	1.84	237%	12.41	15.31	123%
MCE Total		15.77	15.55	99%	103.51	134.53	130%

Table 4-7: Comparison Between Ex Ante Reviewed Versus Evaluated First Year and Lifecycle kWh Savings With Gross Realization Rates – Deemed Measures Only

Program Name	Measure Group	First Year kWh			Life Cycle kWh		
		Reviewed	Evaluated	GRR	Reviewed	Evaluated	GRR
Small Commercial	Lighting indoor CFL basic	2,691	1,405	52%	32,297	11,932	37%
Small Commercial	Lighting indoor LED lamp	38,151	16,482	43%	224,055	237,522	106%
Small Commercial	Lighting indoor LED reflector lamp	29,834	38,678	130%	168,892	240,578	142%
Small Commercial	Lighting indoor linear fluorescent delamping	2,441	7,291	299%	39,055	60,694	155%
MCE Total		73,117	63,857	87%	464,299	550,726	119%

In a comparison between corrected ex ante values versus evaluation results, realization rates were found to be different to varying degrees. Even though both the evaluated and ex ante reviewed numbers are in agreement that the reported life cycle savings are overstated, each piece of analysis states this overestimation to different levels. For LED lamps, the evaluated unit energy savings are less than the corrected ex ante numbers, but the evaluated EUL values are larger than the corrected ex ante values. For LED reflector lamps it was found that the evaluated unit energy savings are larger than the corrected ex ante numbers. These two measure groups drive the total realization rates and counteract each other's variance. Although the overall realization rates may seem to suggest consistency between the ex ante review and application of evaluation results, there is still much variability. Further work is needed to reconcile the evaluation data and ex ante data for the measures reviewed. This reconciliation should reveal

discrepancies in ex ante assumptions and inputs vital to accurately estimating energy savings for future program cycles.

4.1.3 Evaluation Update of Calculated Commercial Lighting Measures

Overview

This section details the approach that the evaluation team used to estimate evaluated gross impacts associated with calculated commercial lighting measures in MCE. Along with the approach, this section documents the data sources used, the results of the evaluation, as well as conclusions and recommendations that are intended to help inform future program planning.

Approach and Findings

The evaluation team conducted a site-specific gross impact evaluation for a number of program participants in MCE. The goal of this impact evaluation was to, not only update gross impacts associated with these calculated projects, but to compare those impacts to the ex ante gross impact assumptions.

In order to perform this analysis, the evaluation team requested the project workbooks and applications for all of the calculated lighting projects that were conducted in 2014. These calculation workbooks detail each of the impact parameters that were used to develop the site-specific ex ante gross savings that are documented in the tracking data.

As detailed below in Table 4-8, ex ante calculated savings were represented in 66 claims, representing 38 projects within 35 unique sites. Of those 66 claims, the evaluation team analyzed 36 claims or 53% of total first year ex ante savings. While the initial intent was to evaluate a much greater percentage of the overall claim, there were discrepancies between the savings calculated in the workbooks and the final savings claimed in the tracking data for a number of projects. These projects were excluded from the evaluation analysis given the inherent difficulty in truing up the ex ante savings. The first year kW and kWh savings that are detailed below represent the ex ante claimed savings before the 0.90 ex ante realization rate was applied to them.

Table 4-8: MCE Calculated Evaluation Analysis

Evaluated Update	Claims	Site Projects	Sites	First Year Savings (kW)	First Year Savings (kWh)
No	30	20	20	45	334,342
Yes	36	19	18	55	377,632
Total	66	38	35	100	711,973

The 36 claims that were updated represent a heterogeneous distribution of measures. Table 4-9 details that distribution. Of the 36 claims, 21 represented LED measures, eight represented linear fluorescents, two represented occupancy sensors and four represented CFLs. This was an important consideration when developing the evaluation analysis plan as each of these measures tend to have very different unit energy savings values and EUL considerations. Due to the representativeness of the sample evaluated across all measure groups, the gross realizations that were developed for the evaluated population were used to update the measures that were not evaluated.

Table 4-9: MCE Calculated Evaluation Analysis by Measure Group

Measure Group	Evaluation Update	Claims	Site Projects	Sites	Ex ante First Year Savings (kW)	Ex ante First Year Savings (kWh)
Lighting indoor CFL other	No	3	3	3	7	36,495
Lighting indoor CFL other	Yes	3	3	3	6	24,406
Lighting indoor controls wall or ceiling mounted occupancy sensor	Yes	2	2	1	-	616
Lighting indoor LED lamp	No	4	4	4	9	43,305
Lighting indoor LED lamp	Yes	9	8	8	12	110,016
Lighting indoor LED other	No	3	3	3	5	29,472
Lighting indoor LED other	Yes	4	4	4	4	32,828
Lighting indoor linear fluorescent	No	7	7	7	6	22,535
Lighting indoor linear fluorescent	Yes	8	8	7	32	106,503
Lighting outdoor CFL basic	No	1	1	1	-	435
Lighting outdoor CFL basic	Yes	1	1	1	-	27,060
Lighting outdoor LED other	No	11	10	10	15	183,814
Lighting outdoor LED other	Yes	8	8	8	0	71,041
Refrigeration case LED lighting	No	1	1	1	4	18,286
Refrigeration case LED lighting	Yes	1	1	1	1	5,162

Each of the calculation workbooks provided detailed information regarding how the ex ante savings claims were developed. The calculated savings were developed using the following.

- Measure quantity – This represents the number of units (lamps/controls/fixtures) that were removed and had been installed.
- Baseline wattage – Two baseline wattage values were provided. These two values represented the wattage of the replaced equipment as well as an industry standard

practice (or code) baseline. For replacement on burn-out (ROB) measures, the code wattage represents the baseline condition. For early replacement (ER), the code baseline is used as the second baseline (or post-RUL) period. The wattage of the replaced equipment is used for the remaining useful life (RUL) of the baseline equipment for ER measures.

- Retrofit Wattage – This is the wattage associated with the installed lighting measure.
- Activity Area – This field detailed where the measure installation was made (i.e., restroom, sales area, outdoors). While the activity area designation was provided for each measure in every calculation workbook, activity area level operating hours and coincidence factors were never used.
- ER Flag – This flag details whether or not the measure was ER or ROB. For ROB measures, the code baseline is used to calculate first year savings and extends throughout the lifecycle of the measure. For ER measures, the lifecycle savings are calculated over two distinct time periods. During the first period (RUL), the wattage of the replaced equipment is used as the baseline and, throughout the post-RUL period, the code baseline is used for the remaining EUL of the measure.
- Operating Hours – This represents the annual operating hours for the facility. Every custom project utilized DEER default operating hours (which are based on the building type of the facility). All exterior measures were assumed to be 4,100 hours.
- Coincidence Factor (CF) – This represents the percentage of time that the measure is operating throughout the peak demand period. DEER default CFs were used for every project.
- Interactive Effects – These demand and energy factors are incorporated into the measure impact. The kWh factors are multiplied by the annual kWh impact and the kW factors are multiplied by the kW demand impact. The factors differ based on whether a measure is a CFL or not, the PA, the climate zone of the participant, the building type, and whether or not the facility is new or existing.
- Occupancy Sensor flags – If occupancy sensors were installed and weren't required by code, these fields are filled in. These fields include the activity area of installation, the quantity installed, and the change in operating hours with the control installation (or, the percent time off [PTO]).

Overall, the ex ante assumptions that were detailed in the workbooks were detailed and complete. For example, when an LED or T8 fixture was replacing a T12 fixture, the ex ante code baseline was a first generation T8 since T12 lamps began being phased out in 2012. When metal halides were replaced by an LED or high occupancy (HO) T5, the code baseline was a pulse start metal halide which is consistent with Title 20. Measure installations were provided at the activity area level even though operating hour assumptions were made at the building type

level. Two baseline savings estimates were also provided – one for measures that were assumed to be ROB and one for measures that were assumed to be ER.

The evaluation team analyzed each of these parameters at the site-specific level and applied evaluated results to many of the parameters on a case-by-case basis. Several of the parameters, however, were not updated. For example, the measure quantities installed, wattage estimates (baseline and retrofit) and interactive effects were not updated. This analysis did not involve on-site verification so it was impossible to confirm or deny the measure disposition or wattage of the equipment. However, if the ER/ROB designation was updated that would have the effect of changing the first and second baseline wattages for those measures.

In order to estimate first year demand and energy savings, several key variables were updated. These included the operating hours, coincidence factor and the PTO for occupancy sensor measures. The ER/ROB designation was also updated if there was a preponderance of evidence that the measure was in fact ROB rather than ER. An example of that type of update is if a measure was classified as ER, but the baseline equipment was an incandescent lamp. Since incandescent lamps have such a short EUL, these replacements should be considered ROB. Code baselines were also updated to reflect the first year savings for ROB measures and the second baseline for ER measures. As mentioned above, these ex ante code baselines were often accurate, but sometimes were left blank (or a hard-coded value was used). In these instances, the evaluated baselines accurately reflected the correct code baseline associated with the measure.

The evaluated operating hours were developed at the measure, building type, and activity area level using logger data from the 2006-08 and 2010-12 evaluation periods as well as adjusted self-report operating schedules for the 2013 program period. In total, previously collected data from over 8,000 loggers representing 1,700 sites were used in the adjustment process. The logger data was combined with the adjusted self-reports to develop market segment-activity area lighting profiles for LED lamps, linear fluorescents, high bay fluorescents, CFL lamps and occupancy sensors. The calculation workbook provided detailed information regarding the measure installed (LED A-lamp vs. LED reflector lamp), the activity area of installation (restroom vs. retail area) and the building type (office vs. retail). The evaluated operating hours were applied at that level. If a specific combination of measure-activity area-building type was represented in the ex ante workbook and the evaluated operating hours associated with that combination were either absent or unreliable, an overall hours of use was created at the measure-building type level. A similar process was developed for the CF which was represented as the percent “ON” throughout the peak demand period.

Two other parameters that were updated were the measure EUL and the RUL (for ER measures). For most lighting measures, the EUL represents the service life in hours of the measure retrofitted – which typically represents the lamp life for CFLs and LEDs and the ballast service life for linear fluorescent measures – divided by the evaluated operating hours or 15 years,

whichever is less. The service life that was used for each of the measures that were evaluated are as follows; CFL lamps – 10,000 hours, LED lamps – 25,000 hours, CFL/LED fixtures – 49,000 hours, linear fluorescents – 70,000 hours. For occupancy sensor measures the evaluated EUL was set to 8 years. If it was determined that an installation was ER, the RUL was estimated as one third of the EUL, following the DEER methodology.

One final consideration that had a significant impact on the overall GRRs (especially lifecycle savings) is how the ex ante savings were reported in the tracking data. As mentioned above, if a measure was determined to be ER in the ex ante case, the calculation workbook provided two baseline savings estimates – one for the RUL period using the baseline wattage and one for the post-RUL period using a code baseline. These two values were presented as annualized savings. In other words, the workbooks did not detail ex ante EUL or RUL assumptions and, by extension, no lifecycle savings estimates. Rather, depending on whether or not the measure was ER or ROB, the first year savings represented that baseline condition. These savings were then multiplied by the EUL reported in the tracking data. One consequence of this calculation methodology is that it potentially overstates the lifecycle savings of the measure. For example, if a linear measure has a 15 year EUL and was determined to be ER, the ex ante lifecycle savings represents the first baseline (using the baseline wattage) times the 15 years. The evaluated analysis examined the lifecycle savings over two periods – the RUL period which would be 15 divided by three, resulting in an RUL of five years. The annualized savings over those five years would include the first baseline. However, the second period or the post-RUL uses the second baseline (or code), which is generally lower than the first period for the remaining 10 year EUL (15 years minus five years).

Overall, the gross first year realization rate for the claims that were evaluated was 82% and 94% for kW and kWh, respectively. The gross lifecycle realization rate was 68% and 75% for kW and kWh, respectively. In order to explain why the gross realization rates (GRR) differ from 100%, the evaluation team compared the ex ante and evaluated parameter estimates for each of the calculated measures. Below is a discussion of each evaluated measure and an explanation of how each of the parameters contribute to the GRR differing from 100%

Indoor CFL

For indoor CFL measures, the first year kWh GRR was roughly 96% and the lifecycle kWh GRR was 124%. The main reason why the first year GRR was less than 100% is that evaluated operating hours were roughly 15% less than ex ante assumptions. The lower evaluated operating hours led to a higher evaluated EUL which translated into greater evaluated lifecycle savings. A similar trend is evident for first year and lifecycle kW GRR (94% and 124%, respectively). The evaluated coincidence factors were roughly 15% less than ex ante assumptions.

Indoor and Outdoor LED

For indoor LED lamp measures, the first year kWh GRR was roughly 91% and the lifecycle kWh GRR was 58%. The main reason why the first GRR was less than 100% is that evaluated operating hours were roughly 18% less than ex ante assumptions. Unlike CFLs, the lower evaluated operating hours led to much lower evaluated lifecycle savings. The main reason for this is that the ex ante EUL for all LED measures was 15 years whereas the evaluated EUL was closer to 10 years. A similar trend is evident for first year and lifecycle kW GRR (94% and 46%, respectively). The evaluated coincidence factors were roughly 15% less than ex ante assumptions.

For indoor LED “Other” measures which consists of LED fixture installations, the first year kWh GRR was roughly 93% and the lifecycle kWh GRR was 58%. The evaluated EUL is roughly 38% less than the ex ante assumption, thus leading to a lower evaluated lifecycle GRR. The first year and lifecycle kW GRR are much lower than the kWh GRR (54% and 40%, respectively). While the evaluated and ex ante delta wattages are identical and the evaluated CF, on average, is 30% higher than ex ante assumptions, one site claimed demand savings even though the measures were installed on the exterior of the building. The evaluated peak demand savings were zeroed out, which led to a significant reduction in the overall kW GRR.

For outdoor LED measures, the first year kWh GRR was roughly 100% and the lifecycle kWh GRR was 76%. Since the vast majority of these measures were installed on the exterior of buildings, both the evaluated and ex ante operating hours assumptions were the DEER default of 4,100 hours. A 21% reduction in lifecycle GRR is explained again by higher ex ante EUL assumptions.

Linear Fluorescents

For indoor linear fluorescent measures, the first year kWh GRR was roughly 85% and the lifecycle kWh GRR was 80%. Overall, the evaluated operating hour estimates were roughly 12% less than ex ante assumptions and the evaluated EUL was roughly 7% less than ex ante assumptions. The first year and lifecycle kW GRR were 76% and 72%, respectively. The evaluated CF was roughly 27% less than ex ante assumptions.

Occupancy Sensors

For indoor occupancy sensors, the first year kWh GRR was roughly 47% and the lifecycle kWh GRR was 47% as well. The primary reason for the relatively low realization rate was that the ex ante baseline operating hours were much greater than evaluated estimates. The controlled wattage was identical going from ex ante to evaluated wattage having little effect on the realization rate, and the evaluated percent time off (PTO) was actually greater than ex ante

assumptions which had the effect of increasing the realization rate. An 8 year EUL was used for both the ex ante and evaluated lifecycle savings calculation.

Results

The objective of this analysis was to develop GRRs that could be used to estimate PA-level savings across all custom lighting measure groups. The results of that analysis are presented in the tables below. As presented in Table 4-9 earlier, the evaluation team was able to perform an evaluated analysis on a majority of the claims and ex ante claimed savings for each measure group. The GRRs that were developed for each of the evaluated measure groups were then applied back to each non-evaluated project in the custom population (by measure group). It is important to note that the ex ante savings and, by extension, the GRRs that are presented below include the 0.9 ex ante realization rate. The data that were presented above in the findings do not have that realization rate applied to them so that a more direct comparison could be made with the application calculations. Table 4-10 presents the kW savings, Table 4-11 presents the kWh savings, and Table 4-12 presents the therm savings.

Overall, the first year kW, kWh, and therm GRR were 100%, 105% and 101%, respectively. As discussed in the previous section, the GRR incorporates several impact parameters including installation rates, operating hours, coincidence factors, installed/replaced wattages and industry standard practice (or code) baselines. These parameters are different depending on the building type of installation, the activity area of installation, the measure installed and the measure that was replaced. These nuances explain the differences that can be seen in the GRR when examined at the measure group level.

Overall, the lifecycle kW, kWh and therm GRR were 77%, 81% and 74%, respectively. Along with the parameters discussed above, the differences associated with the EUL for ROB measures and a combination of the EUL and RUL for ER measures create an additional layer of complexity. The lower lifecycle GRRs (both overall and at the measure group level) are explained by significant differences in the ex ante and evaluated EULs for certain measures along with differences in calculating the lifecycle savings associated with dual baseline measures.

Table 4-10: Comparison Between Reported Versus Evaluated First Year and Lifecycle kW Savings – Calculated Measures Only

Measure Group	First Year kW			Life Cycle kW		
	Reported	Evaluated	GRR	Reported	Evaluated	GRR
Lighting indoor occupancy sensor	-	-		-	-	
Lighting indoor CFL other	11.92	12.40	104%	75.75	104.01	137%
Lighting indoor LED lamp	18.55	19.32	104%	220.86	112.33	51%
Lighting indoor LED other	7.60	4.60	61%	108.35	47.78	44%
Lighting indoor linear fluorescent	34.95	28.68	84%	509.27	408.02	80%
Lighting outdoor CFL basic	-	-		-	-	
Lighting outdoor LED other	13.58	19.18	141%	203.69	201.00	99%
Refrigeration case LED lighting	4.24	5.59	132%	63.65	38.86	61%
MCE Small Commercial Total	89.85	89.77	100%	1,181.58	912.00	77%

Table 4-11: Comparison Between Reported Versus Evaluated First Year and Lifecycle kWh Savings – Calculated Measures Only

Measure Group	First Year kWh			Life Cycle kWh		
	Reported	Evaluated	GRR	Reported	Evaluated	GRR
Lighting indoor occupancy sensor	554	287	52%	4,436	2,297	52%
Lighting indoor CFL other	54,811	58,210	106%	312,574	431,734	138%
Lighting indoor LED lamp	137,989	140,042	101%	1,783,313	1,149,413	64%
Lighting indoor LED other	56,070	58,038	104%	812,425	525,678	65%
Lighting indoor linear fluorescent	116,134	110,134	95%	1,741,956	1,547,888	89%
Lighting outdoor CFL basic	24,745	27,495	111%	293,202	325,780	111%
Lighting outdoor LED other	229,370	254,649	111%	3,270,743	2,761,856	84%
Refrigeration case LED lighting	21,103	21,448	102%	316,548	149,016	47%
MCE Small Commercial Total	640,776	670,303	105%	8,535,196	6,893,661	81%

Table 4-12: Comparison Between Reported Versus Evaluated First Year and Lifecycle Therms Savings – Calculated Measures Only

Measure Group	First Year Therms			Life Cycle Therms		
	Reported	Evaluated	GRR	Reported	Evaluated	GRR
Lighting indoor occupancy sensor	(2)	(1)	52%	(18)	(9)	52%
Lighting indoor CFL other	(365)	(390)	107%	(2,033)	(2,811)	138%
Lighting indoor LED lamp	(906)	(840)	93%	(11,066)	(5,679)	51%
Lighting indoor LED other	(358)	(408)	114%	(4,964)	(3,716)	75%
Lighting indoor linear fluorescent	(516)	(492)	95%	(7,740)	(6,887)	89%
Lighting outdoor CFL basic	-	-		-	-	
Lighting outdoor LED other	(484)	(537)	111%	(7,264)	(6,108)	84%
Refrigeration case LED lighting	(163)	(165)	102%	(2,442)	(1,150)	47%
MCE Small Commercial Total	(2,794)	(2,834)	101%	(35,528)	(26,359)	74%

4.1.4 Final Evaluated Results for MCE Small Commercial and Multifamily Measures

As discussed above, evaluated values were developed for all MCE small commercial and multifamily measures through multiple processes. If a measure was part of either the evaluation update for deemed or calculated lighting measures, as described above in sections 4.1.2 and 4.1.3, those evaluated gross values were used. Otherwise, if the ex ante savings were corrected as part of the ex ante review described in section 4.1.1, those corrected values were used for the evaluated gross savings. If neither process resulted in an evaluated value, the ex ante gross savings values were passed through.

Table 4-13 through Table 4-15 provide a comparison of the reported ex ante claimed gross savings values and the evaluated gross savings values. Both first year and lifecycle gross savings values are provided along with the corresponding realization rate for kW, kWh and therm savings, respectively. Overall, first year gross realization rates for kW and kWh are 95% and 101%. Although these numbers may appear to indicate some level of reliability in the individual ex ante values, measure specific realization rates can vary significantly. Lifecycle gross realization rates for kW and kWh are lower for various reasons as explained in the analysis subsections above, and are 76% and 80%, respectively.

First year and lifecycle gross realization rates for therm savings are 86% and 97%, but this result is confounded by a combination of negative and positive therm values. Looking only at the positive therm values (for multifamily non-lighting measures), the first year and lifecycle gross realization rates for therm savings are 92% and 86%.

Table 4-13: Comparison Between Reported Versus Evaluated First Year and Lifecycle kW Savings with Gross Realization Rates – All MCE Measures

Program Name	Measure Group	First Year kW			Life Cycle kW		
		Reported	Evaluated	GRR	Reported	Evaluated	GRR
Multifamily	Building envelope window film	-	-		-	-	
Multifamily	Lighting indoor CFL basic	2.19	2.18	100%	24.04	21.05	88%
Multifamily	Lighting indoor CFL fixture	1.22	0.77	63%	13.46	2.53	19%
Multifamily	Lighting indoor CFL globe	0.01	0.01	99%	0.10	0.08	87%
Multifamily	Lighting indoor linear fluorescent	0.54	0.48	90%	8.04	7.24	90%
Multifamily	Lighting outdoor CFL basic	-	-		-	-	
Multifamily	Lighting outdoor LED fixture	-	-		-	-	
Multifamily	Other	0.15	0.15	97%	2.30	2.23	97%
Multifamily	Pipe insulation hot application	-	-		-	-	
Multifamily	Water heating faucet aerator	0.01	0.01	99%	0.15	0.15	99%
Multifamily	Water heating showerhead	-	-		-	-	
Multifamily	Water heating storage water heater	0.01	-	0%	0.13	-	0%
Small Commercial	Lighting indoor occupancy sensor	-	-		-	-	
Small Commercial	Lighting indoor CFL basic	0.62	0.26	43%	6.83	2.24	33%
Small Commercial	Lighting indoor CFL other	11.92	12.40	104%	75.75	104.01	137%
Small Commercial	Lighting indoor LED fixture	1.90	1.89	100%	22.77	22.74	100%
Small Commercial	Lighting indoor LED lamp	24.26	23.37	96%	289.31	170.91	59%
Small Commercial	Lighting indoor LED other	7.60	4.60	61%	108.35	47.78	44%
Small Commercial	Lighting indoor LED reflector lamp	5.57	9.39	169%	64.24	58.40	91%
Small Commercial	Lighting indoor linear fluorescent	33.95	28.68	84%	509.27	408.02	80%
Small Commercial	Lighting indoor linear fluorescent delamping	9.16	1.84	20%	70.17	15.31	22%

Table 4-13 (Cont'd): Comparison Between Reported Versus Evaluated First Year and Lifecycle kW Savings with Gross Realization Rates – All MCE Measures

Program Name	Measure Group	First Year kW			Life Cycle kW		
		Reported	Evaluated	GRR	Reported	Evaluated	GRR
Small Commercial	Lighting indoor other	-	-		-	-	
Small Commercial	Lighting outdoor CFL basic	-	-		-	-	
Small Commercial	Lighting outdoor LED other	13.58	19.18	141%	203.69	201.00	99%
Small Commercial	Other	0.20	0.20	100%	2.40	1.60	67%
Small Commercial	Refrigeration case LED lighting	4.24	5.59	132%	63.65	38.86	61%
Small Commercial	Refrigeration door closer	0.32	0.32	100%	2.58	2.58	100%
Small Commercial	Refrigeration other	7.72	7.72	100%	80.66	69.59	86%
MCE Total		125.17	119.05	95%	1,547.90	1,176.31	76%

Table 4-14: Comparison Between Reported Versus Evaluated First Year and Lifecycle kWh Savings With Gross Realization Rates – All MCE Measures

Program Name	Measure Group	First Year kWh			Life Cycle kWh		
		Reported	Evaluated	GRR	Reported	Evaluated	GRR
Multifamily	Building envelope window film	-	-		-	-	
Multifamily	Lighting indoor CFL basic	24,315	23,841	98%	267,464	230,544	86%
Multifamily	Lighting indoor CFL fixture	5,807	3,658	63%	63,873	12,020	19%
Multifamily	Lighting indoor CFL globe	100	101	101%	1,104	976	88%
Multifamily	Lighting indoor linear fluorescent	5,622	5,059	90%	84,323	75,891	90%
Multifamily	Lighting outdoor CFL basic	16,895	16,895	100%	50,893	50,893	100%
Multifamily	Lighting outdoor LED fixture	23,183	23,183	100%	292,378	292,378	100%
Multifamily	Other	1,168	1,370	117%	17,664	20,695	117%
Multifamily	Pipe insulation hot application	-	-		-	-	

Table 4-14 (Cont'd): Comparison Between Reported Versus Evaluated First Year and Lifecycle kWh Savings With Gross Realization Rates – All MCE Measures

Program Name	Measure Group	First Year kWh			Life Cycle kWh		
		Reported	Evaluated	GRR	Reported	Evaluated	GRR
Multifamily	Water heating faucet aerator	194	192	99%	1,939	1,924	99%
Multifamily	Water heating showerhead	-	-		-	-	
Multifamily	Water heating storage water heater	15	-	0%	302	-	0%
Small Commercial	Lighting indoor occupancy sensor	554	287	52%	4,436	2,297	52%
Small Commercial	Lighting indoor CFL basic	3,028	1,405	46%	33,311	11,932	36%
Small Commercial	Lighting indoor CFL other	54,811	58,210	106%	312,574	431,734	138%
Small Commercial	Lighting indoor LED fixture	9,271	9,292	100%	111,253	111,509	100%
Small Commercial	Lighting indoor LED lamp	164,447	156,524	95%	2,100,815	1,386,935	66%
Small Commercial	Lighting indoor LED other	56,070	58,038	104%	812,425	525,678	65%
Small Commercial	Lighting indoor LED reflector lamp	26,404	38,678	146%	304,139	240,578	79%
Small Commercial	Lighting indoor linear fluorescent	116,134	110,134	95%	1,741,956	1,547,888	89%
Small Commercial	Lighting indoor linear fluorescent delamping	28,470	7,291	26%	218,080	60,694	28%
Small Commercial	Lighting indoor other	-	-		-	-	
Small Commercial	Lighting outdoor CFL basic	24,745	27,495	111%	293,202	325,780	111%
Small Commercial	Lighting outdoor LED other	229,370	254,649	111%	3,270,743	2,761,856	84%
Small Commercial	Other	640	640	100%	7,680	5,120	67%
Small Commercial	Refrigeration case LED lighting	21,103	21,448	102%	316,548	149,016	47%
Small Commercial	Refrigeration door closer	3,005	3,005	100%	24,038	24,040	100%
Small Commercial	Refrigeration other	57,569	57,518	100%	596,488	519,060	87%
MCE Total		872,920	878,914	101%	10,927,628	8,789,436	80%

Table 4-15: Comparison Between Reported Versus Evaluated First Year and Lifecycle Therm Savings With Gross Realization Rates – All MCE Measures

Program Name	Measure Group	First Year Therms			Life Cycle Therms		
		Reported	Evaluated	GRR	Reported	Evaluated	GRR
Multifamily	Building envelope window film	19	19	100%	383	383	100%
Multifamily	Lighting indoor CFL basic	(598)	(579)	97%	(6,576)	(5,595)	85%
Multifamily	Lighting indoor CFL fixture	(35)	(22)	63%	(385)	(72)	19%
Multifamily	Lighting indoor CFL globe	(3)	(2)	95%	(28)	(24)	84%
Multifamily	Lighting indoor linear fluorescent	-	-		-	-	
Multifamily	Lighting outdoor CFL basic	-	-		-	-	
Multifamily	Lighting outdoor LED fixture	-	-		-	-	
Multifamily	Other	1,417	1,176	83%	21,638	18,028	83%
Multifamily	Pipe insulation hot application	296	296	100%	3,850	3,850	100%
Multifamily	Water heating faucet aerator	2,423	2,405	99%	24,226	24,045	99%
Multifamily	Water heating showerhead	3,220	3,207	100%	32,199	32,068	100%
Multifamily	Water heating storage water heater	753	361	48%	15,053	5,414	36%
Small Commercial	Lighting indoor occupancy sensor	(2)	(1)	52%	(18)	(9)	52%
Small Commercial	Lighting indoor CFL basic	(22)	(10)	46%	(237)	(85)	36%
Small Commercial	Lighting indoor CFL other	(365)	(390)	107%	(2,033)	(2,811)	138%
Small Commercial	Lighting indoor LED fixture	(66)	(61)	94%	(789)	(738)	94%
Small Commercial	Lighting indoor LED lamp	(1,076)	(961)	89%	(13,106)	(7,432)	57%
Small Commercial	Lighting indoor LED other	(358)	(408)	114%	(4,964)	(3,716)	75%
Small Commercial	Lighting indoor LED reflector lamp	(172)	(257)	149%	(1,942)	(1,592)	82%
Small Commercial	Lighting indoor linear fluorescent	(516)	(492)	95%	(7,740)	(6,887)	89%

Table 4-15 (Cont'd): Comparison Between Reported Versus Evaluated First Year and Lifecycle Therm Savings With Gross Realization Rates – All MCE Measures

Program Name	Measure Group	First Year Therms			Life Cycle Therms		
		Reported	Evaluated	GRR	Reported	Evaluated	GRR
Small Commercial	Lighting indoor linear fluorescent delamping	(157)	(40)	26%	(1,206)	(336)	28%
Small Commercial	Lighting indoor other	-	-		-	-	
Small Commercial	Lighting outdoor CFL basic	-	-		-	-	
Small Commercial	Lighting outdoor LED other	(484)	(537)	111%	(7,264)	(6,108)	84%
Small Commercial	Other	(3)	(3)	100%	(36)	(24)	67%
Small Commercial	Refrigeration case LED lighting	(163)	(165)	102%	(2,442)	(1,150)	47%
Small Commercial	Refrigeration door closer	-	-		-	-	
Small Commercial	Refrigeration other	(87)	(87)	100%	(1,042)	(1,040)	100%
MCE Electric Subtotal		(4,106)	(4,017)	98%	(49,807)	(37,618)	76%
MCE Gas Subtotal		8,127	7,464	92%	97,349	83,789	86%
MCE Total		4,021	3,447	86%	47,541	46,171	97%

4.2 BayREN and SoCalREN Multifamily Measures

This section discusses the various analysis methods and results for the savings and baseline assessments for the BayREN and SoCalREN multifamily measures. The engineering simulation model review, engineering desk review, and consumption analysis assessed savings using differing techniques and methods. Each methodology is described in-depth in the sections that follow. An initial step of these analyses was to conduct a comprehensive review of the tracking and database systems for the multifamily Whole Building programs for both BayREN and SoCalREN, as well as the IOUs. The goal of this assessment was to ensure that the necessary data to assess program impacts were collected and fully populated; this assessment was not intended to verify the accuracy of the data. This review is also discussed below.

4.2.1 Database Assessment

The team requested the IOU and REN tracking databases and CPUC-claimed savings information for review as part of the database assessment task. As part of this assessment, the

evaluation team ensured that the following fields were populated in the IOU- and REN-provided databases:

- Participant contact information
- Measures installed
 - Quantity
 - Location
 - Efficiency
- Preexisting conditions, including measure efficiency³⁵
- Types of and fuels for property hot water, cooling, and space heating systems
- Utility account numbers for both common areas and units for each participating property.

The completeness of multifamily Whole Building data varied substantially between implementers. The SDG&E data were the most comprehensive of the programs, and contained nearly every piece of requested information. Initially, BayREN was not tracking necessary measure-level details; however, BayREN chose to review past project data to populate a database to facilitate this evaluation. BayREN and SoCalREN backup documentation, such as work papers, procedures, and project site assessments were very useful to flesh out project specifics. SoCalREN provided some, but not all, necessary information. For example, SoCalREN provided the number, quantity, and efficiency of installed measures, but not the location. PG&E was unable to provide any measure-level information and, as a result, could not be evaluated.³⁶

Table 4-16 illustrates the completeness of the multifamily Whole Building databases. In the table, a ● symbol indicates that the data provided were completely populated; the ◐ symbol indicates that some of the data were populated; and the ○ symbol indicates that most or all of the requested data were missing or inaccessible.

³⁵ Preexisting conditions are important for assessing the baseline for ER measures.

³⁶ The evaluation team and Energy Division personnel made multiple requests for the PG&E data, including e-mails, EEstats requests, and conference calls. PG&E representatives reported that the program was not tracking this measure-level data during the pilot phase of the program.

Table 4-16: Multifamily Whole Building Database Completeness

Attribute	PA			
	SDG&E	PG&E	BayREN	SoCalREN
Participant Contact Information	●	●	●	●
Measure Details				
Type	●	○	●	●
Quantity	◐	○	●	●
Location	●	○	●	○
Efficiency	●	○	●	●
Preexisting Conditions	●	○	●	●
Property Systems (Type and Fuel)				
Hot Water Systems	●	○	○	◐
Space Cooling	●	○	◐	◐
Space Heating	●	○	◐	◐
Property Details				
Quantity of Tenant Units	●	○	●	●
Bedrooms	●	○	●	●
Bathrooms	●	○	●	●
Utility Account Numbers				
Tenant Spaces	●	○	◐	○
Common Areas	●	●	◐	●

4.2.2 Engineering Simulation Model Review

The goal of the model comparison was to validate the assumptions and understand the magnitude of differences between different entities that are using the same EnergyPro software to model energy savings for the projects. To accomplish this review, the team first reached out to internal engineers (internal to the evaluation team) to understand how the EnergyPro models work and the nuances associated with the inputs and assumptions used for the model. The discussions with engineers were also used to help inform the second task associated with the model review, which was to interview representatives of the three entities that were able to provide model files: SDG&E, BayREN, and SoCalREN.

After the interviews with the engineering team and the three PAs, the evaluation team identified projects deemed to be the most similar across all three entities (SoCalREN, BayREN, and SDG&E). The team leveraged the data provided by program tracking systems to identify similar projects across all three entities, which included the same measures, but was limited by the available project model files. The total number of available project files provided by each organization included two projects for SDG&E, two projects for SoCalREN, and 81 for BayREN. The three site projects selected—one site/project for each organization—are shown in

Table 4-17, along with each site/project associated installed measure quantities. Having three projects that all received identical measures and having additional projects to review would have been ideal, but because of the limited project depth for some of the PAs, the team had to identify the closest match across the three organizations.

Table 4-17: Measures Included for Model Comparison for Similar Projects¹

Measure	SDG&E	BayREN	SoCalREN	Validation Check
Refrigerator	✓	✓	✓	External Spreadsheets
Windows	✓	✓	✓	EnergyPro
Faucet Aerator		✓	✓	External Spreadsheets
Indoor CFLs		✓	✓	External Spreadsheets

¹ Though the RENs (and SDG&E) report energy savings at the project level, the evaluation team received measures-level data to identify high-impact measures for model review. Unfortunately, measure-level savings were deemed unreliable since they did not sum to project-level savings.

Once the three projects were identified, the team reviewed the EnergyPro input files (and any other file) that included energy savings calculations external to the EnergyPro software. This review was done for the single project identified for each of the three entities. As shown, windows represented the only common measure across the three groups that involved EnergyPro usage, so the team limited the review to the windows measure assumptions as input into EnergyPro.

After the projects for model comparison were identified but before the actual review, the team held discussions with engineers who frequently use the EnergyPro software to better understand how the model works and to gain perspective on how differences in inputs or field staff could affect the model outputs. These discussions revealed several key findings.

- In theory, the results should be similar for similar projects even if all the inputs are not identical.
- There is not a rigid formula to follow because many options exist for entering detailed building data.
- The detail of each model is dependent on the budget and time allotted for each project; there is a trade-off between accuracy and resources.
- EnergyPro was not originally developed with existing building retrofits in mind. Instead, the focus of the software was on new construction, with retrofits as a secondary feature that users are able to “manipulate” the software to model.

- Based on the experience of evaluation engineers, the model has shown poor accuracy for existing retrofits and is better suited to new construction. The engineers did, however, indicate that this issue may have been addressed with recent software upgrades and modules.

The evaluation team's next step was to schedule in-depth interviews with representatives of the two RENs and SDG&E (when this evaluation took place, SDG&E was the only IOU to have completed Whole Building projects outside of a pilot program) to understand how they use EnergyPro. Before the interviews, program implementation staff members for the two RENs were able to provide the team with detailed program technical memos that included policies, procedures, and savings assumptions used for their programs. BayREN and SoCalREN's technical memos include programmatic details, although the details differ. The BayREN document is comprehensive and includes all policies and procedures for program implementation, including, but not limited to, participation process, implementation roles and responsibilities, recruitment, eligibility, rebate process, site visits, data collection, energy savings methodologies, and quality assurance procedures. The SoCalREN document is not as comprehensive, but includes a basic program overview and focuses on measure-specific calculation methodology. RHA, the contractor who manages the SDG&E Multifamily Whole Building program, provided documentation that included statewide guidelines³⁷ and a presentation³⁸ on whole building modeling coupled with a process flowchart for how projects are initiated and developed.

Per the SoCalREN technical memo,³⁹

This Energy Network Multifamily Program (Program) Technical Memo describes a process in which the EnergyPro Nonresidential Performance Module will be utilized to recommend packages of energy efficiency measures, ensure that each project meets minimum program performance thresholds, and describes the reporting process for savings. The Program requires the use of EnergyPro software to provide a consistent energy savings analysis process while allowing a custom, whole building performance approach for each upgrade project completed in the program.

37 Energy Upgrade CA Multifamily Energy Modeling Guidelines v1.1.

www.energysoft.com/Files/Guides/EUC%20MF%20Energy%20Modeling%20Guideline_Version%201.pdf

38 "Energy Upgrade California® – Energy Modeling High-Rise Multifamily", HMG, Inc. 2012

39 SoCalREN Multifamily Program Technical Memo.docx; Build-it-Green, 2014.

The team received valuable feedback on program implementation related to the EnergyPro modeling software from the staff interviews and the technical memos. These two information sources allowed the team to identify common practices and differences among the three PAs. Table 4-18 reviews the key similarities and differences.

Table 4-18: Comparison of Assumptions between the RENs and SDG&E

Model Details	SDG&E	BayREN	SoCalREN
Who Inputs Model?	Trained Contractors/Raters	Association for Energy Affordability (AEA) Staff	Trained Contractors/Raters
Who QA/QCs Model?	RHA	AEA and Bevilacqua-Knight Inc. (BKl)	Build-it-Green
Use of External Calculators?	No	Yes	Yes
Rater Certification?	Home Energy Rating System (HERS) II	Building Performance Institute (BPI), HERS II, Multifamily Green Point Rater, Multifamily Building Analyst	BPI, HERS II, Multifamily Green Point Rater, Multifamily Building Analyst
EnergyPro Training Course?	Yes	No	No
EnergyPro Module	EnergyPro Nonresidential	EnergyPro Lite (Nonresidential)	EnergyPro Nonresidential (for Low-Rise Residential–Performance Module Used)
Dual Baseline Scenarios? ¹	No	No	Yes
Existing Conditions Baseline?	Yes	Yes	Yes
Models Calibrated to Billing Data?	No	No	No
Comprehensiveness of Technical Guidelines Documentation	Basic Process Flowchart, Standard EUC Guidelines	Comprehensive Measure-Level and Implementation Details	Comprehensive Measure-Level Details, but Lacks Implementation Details

¹ Dual baseline scenarios run two models: one using project existing conditions as the baseline and one using code (Title 24) as the baseline.

Some of the notable differences across the three organizations are discussed in greater detail in the following subsections.

EnergyPro Versions

According to the in-depth interviews, BayREN uses a unique version of EnergyPro, called EnergyPro Lite, which has been built specifically for BayREN. The impetus for this version was to allow a more streamlined interface for collecting site information and to generate quicker results. SoCalREN and SDG&E are using EnergyPro in standard nonresidential modules to

develop scopes of work because these modules offer the full range of EnergyPro features. SoCalREN also uses the residential performance module for low-rise buildings. The most significant difference between EnergyPro Lite and the full EnergyPro versions is that the Lite version has a “Wizard” for inputting building details, which allows basic inputs. The Lite version will then run the model with default assumptions for the window and wall areas, based on the square footage of the building, so an analyst does not have to go in and model them. When asked about potential shortcomings of the EnergyPro software related to the focus on code-compliant new construction (per the discussion with team engineers), both REN staff indicated that although EnergyPro was originally developed for code-compliant new construction software, both REN staff indicated that EnergyPro has since created new modules that tackles retrofit. The new modules offer a different software “engine” and associated underlying assumptions. Ultimately, both EnergyPro tools (the nonresidential performance modules) rely on the same DOE2 engine.

Populating EnergyPro

SoCalREN and SDG&E both use trained contractors or raters; BayREN uses the Association for Energy Affordability (AEA) for project initiation, model inputs, and savings calculations. According to AEA staff members, their job is based on a three-fold objective. The first task is conducting the initial intake call with the participant to start building the initial model with a “ballpark” high-level project overview. The second task is conducting site visits, confirming what goes into the model (e.g., actual existing conditions and equipment verified while on site). Finally, EnergyPro is used to close out the project based on actual installations with a more detailed verification process. For SoCalREN and SDG&E, the modeling involves the second two steps (the initial site-visit-based project initiation and the final project closeout with actual installation verification). Both RENs and SDG&E all require rigorous levels of training and certification requirements for their contractors/raters. Separate in-house staff performs QA/QC for each project.

Exclusive Use of EnergyPro versus Other External Calculators

Both BayREN and SoCalREN get savings calculations from three main sources: EnergyPro, CPUC-specific dispositions (if any), and work papers or DEER-based calculations (the defaults). According to Richard Heath and Associates (RHA) (SDG&E), contractors have the ability to use other software, including external calculators and workbooks, but they only use EnergyPro. The technical memos from the two RENs contained detailed descriptions of the measures that are modeled outside the EnergyPro model, mostly common area and exterior lighting; small domestic hot water (DHW) measures (low-flow showerheads, faucet aerators, pipe insulation, and thermostatic control valves); and various plug loads (common appliances, particularly refrigerators). Table 4-19 reviews the measures for which savings are estimated outside EnergyPro. As the table shows, RHA (SDG&E) does not use spreadsheet templates outside the

EnergyPro model for these measures; the two RENs do. This made it impossible to assess whether the same measures that normally receive energy savings outside EnergyPro receive the same assumptions and calculations for SDG&E as for the two RENs.

Table 4-19: Measures Calculated Outside EnergyPro

Measure Group	SDG&E	BayREN	SoCalREN
Small domestic hot water measures (Including Showerheads, Aerators, Pipe Insulation, and Thermostatic Control Valves)	No	Yes	Yes
Common Area and Exterior Lighting	No	Yes	Yes
Appliances (Refrigerators)	No	No	Yes

A review of the external spreadsheets for two projects (one for BayREN, one for SoCalREN) showed some differences in the assumptions being used in these models. Furthermore, the spreadsheets themselves were developed independently and were not a consistent “template” that ensured that the same savings assumptions were ultimately used for each project. As an example, differences for low-flow showerheads between the BayREN and SoCalREN DHW spreadsheet models included the following:

- Average shower time (BayREN uses 7.4 minutes versus 8.0 minutes for SoCalREN)
- Hot and cold water temperature (BayREN uses 65 cold/106 hot and SoCalREN uses 70 cold/100 hot)
- Throttling factor⁴⁰ (BayREN uses 0.9 throttling factor and the team could find only “line loss” of 2% for the SoCalREN worksheet).

For lighting worksheets, the only difference between the RENs is that BayREN uses annual operating hours (e.g., 4,340 for exterior lighting) and SoCalREN annualizes a rounded daily estimate (12 hours/day, translating to 4,368 annual hours). The team would expect to find differences attributable to climate zones and other jurisdiction-based differences. The lack of consistent assumptions, however, leads the team to believe that the lack of a standard template may be contributing to differences (though in some instances minor) in savings claims that should not be occurring.

The team reviewed the EnergyPro input files across the three selected projects as part of the third and final task for the model comparison. In this review, the team focused exclusively on windows because windows were selected as the only applicable measure common across the three projects. Specifically for windows, the project rater or contractor is required to input the

⁴⁰ Throttling factor is defined as a percent reduction in hot water flow to account for the warm-up period of that flow.

existing fenestration type (number of panes, frame material type), the area, the surface geometry, the overhang, and the side fin. The details are well documented in the EnergyPro documentation guide (see footnote 21 in the guide). As noted previously, windows are one of the measures where the actual efficiency of the baseline equipment is unknown and defaults are required for a baseline. According to the SoCalREN technical memo, older existing windows “will not have gone through NFRC [National Fenestration Rating Council] testing and will not have U-values or SHGC [solar heat gain coefficient] noted.” Accordingly, the team was able to perform only a cursory review of window inputs for each project and verify that all three organizations followed the Whole Building program protocols as defined for windows upgrades.

Baseline Conditions

All three implementers (SDG&E, SoCalREN, and BayREN) are using actual existing building conditions as the assumption of baseline conditions for all participants and all measures.⁴¹ This consistent approach is detailed within the CPUC-based working group — titled the MF Project Coordination Group (PCG)—which is administered by CPUC staff. According to AEA, BKi, and REN staff, PAs and implementers check in continuously on the details and general collaboration on the Multifamily Whole Building programs. Furthermore, AEA serves as the technical implementer for BayREN, MCE, and SCG and is a participating rater in the SoCalREN, PG&E, and SDG&E programs. AEA has completed modeling across these administrators, and is therefore also familiar with each organization’s procedures and sets of guidelines. Although the ideal is to enter actual known equipment specifications, some measures require defaulting because efficiency levels cannot be determined. Measures that require defaults may consist of wall insulation conditions (staff cannot always have ready access to assess the baseline), windows (older windows do not have NFRC efficiency specifications), and older HVAC and large DHW units that often do not have efficiency ratings on nameplate data. To demonstrate the process for determining the baseline equipment, during one interview the team learned that during the audit, the contractor might enter the boiler information along with the nameplate details. The QA/QC process will then involve validating the specifications for that exact boiler and potentially changing them to match the actual on-site values.

Projects also require establishing the RUL because ER is used as the baseline condition for all projects. All organizations follow a consistent procedure for estimating the RUL:

- Each measure receives the standard DEER-based EUL.
- Each measure's lifetime is then weighted by the EnergyPro-based energy savings.

⁴¹ Per Energy Division guidance, SoCalREN will run dual-baseline scenarios, one for existing equipment and one for the Title 24 code baseline.

- The final project-level RUL is then assumed to be one-third of the weighted project estimated life, consistent with the DEER approach.

The evaluation team has found that the application of this logic will result in flawed lifecycle savings estimates. The team applied the above project-level RUL logic in an example project to demonstrate the impacts on lifecycle savings. For this example, the team used two measures with different EULs and first year savings. Measure 1 has an EUL of six years (RUL is one-third of EUL or two years) and saves 10 kWh in the ER period (RUL) and 2 kWh thereafter (code baseline kWh applied for EUL-RUL years). Total lifecycle savings for Measure 1 is 28 kWh. Measure 2 has an EUL of 15 years (RUL is five years) and saves 10 kWh in the ER period (RUL) and 5 kWh thereafter. Total lifecycle savings for Measure 2 is 100 kWh. The total project lifecycle savings is 128 kWh. All of these details are included in Table 4-20 below.

Based on the EUL weighting logic described to the team in the above bullets, to derive the weighted EUL the six-year EUL for measure 1 would be weighted by 10 kWh and the measure 2 15-year EUL would be weighted by 10 kWh, to arrive at an overall project average of 10.5 years. The resulting RUL would be 3.5 years. The savings for the project-level RUL period would be 20 kWh and the post RUL period would be 7 kWh. This results in a total lifecycle savings for the project of 119 kWh, a difference of 9 kWh (or 7% of original lifecycle savings).

Table 4-20: Lifecycle Savings Demonstration using Example Project and REN-based Project-level EUL Logic

Parameter	Measure A	Measure B	Weighted EUL
EUL (years)	6	15	10.5
RUL (years)	2	5	3.5
ER Baseline (kWh)	10	10	20
Code Baseline (kWh)	2	5	7
Lifetime kWh	28	100	119
Total Project kWh	128		119
Lifetime kWh Difference	9		

The evaluation team also discovered, during the review of the EUL and RUL logic detailed here, that both RENs are estimating lifecycle savings using an 18 year EUL in the tracking database. SDGE assigned a 16 or 16.5 EUL for their four EUC-MF projects completed during the 2013-2014 program period. Though large variations in project-EULs were not expected, the evaluation team did expect to see variation in project-level EUL due to the logic described above and knowing that projects received different measure combinations.

Calibrating to Usage (Billing) Data

According to BayREN, actual utility bill data is collected from participants when available. Until then, the program continues to work through avenues such as the CPUC to collect billing data. The availability of billing data can help to refine savings estimations by calibrating the building energy usage. One interviewee, stated that obtaining usage data would place an additional burden on contractors. Although it would be ideal to have access to project-level billing information, this aspect of building calibration has been notoriously difficult because privacy and security concerns have prevented the RENs and their implementers from obtaining this information though recent legislation (AB-802) has been proposed that may help overcome these obstacles.⁴²

In another interesting finding from the in-depth interviews, several different staff members mentioned that the results of the previous single family whole house retrofit evaluation⁴³ showed that the EnergyPro software was greatly over-predicting the realized energy savings for the projects. According to that evaluation,⁴⁴

Staff analysis showed that this software greatly over-predicted program eligible end uses (space heating/cooling and water heating). The over-prediction is not due to any fundamental problems with the modeling software. Rather, the assumptions built into the EnergyPro models about pre retrofit energy consumption of key end uses were not consistent with DEER assumptions and generally predicted far more energy use than indicated by the latest Residential Appliance Saturation Survey (RASS). The RASS yields energy consumption estimates for residential end-uses and application saturations based on household surveys. EnergyPro can generally be expected to provide reasonable results if the input assumptions are revised (such as thermostat set-points, occupancy hours and HVAC faults). Gas use was over-predicted by more than 50%. Final staff direction required electricity consumption savings to be reduced by 60% (instead of the 75% indicated by the staff analysis) and gas savings to be reduced by 20% (instead of the 37% indicated by the staff analysis).

Although the results of the single family Advanced Home Upgrade evaluation are not directly applicable to this multifamily research, the findings support the idea that it is important to look

⁴² https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB802

⁴³ DNV GL; Whole House Retrofit Impact Evaluation;
http://www.calmac.org/publications/CPUC_WO46_Final_ReportES.pdf (Sep 9, 2014)

⁴⁴ CPUC, Ex Ante Review Fact Sheet #3, HVAC Equipment Savings Estimates Assumptions;
<http://www.cpuc.ca.gov/NR/rdonlyres/21D8C436-72AA-4254-AE44-5E036B8C11AA/0/ExAnteReviewFactSheet3HVAC.pdf>

more closely at the input and output assumptions from EnergyPro, and if possible calibrate to actual billing data as a validity check on the savings estimates.

4.2.3 Engineering Desk Review

This analysis consisted of applying inputs found in REN backup documentation to DEER or engineering algorithms, and documenting the resulting savings numbers. The team combined the measure-level evaluated savings into projects and compared these to the project-level savings from the CPUC data to determine a realization rate for kW, kWh, and therm savings estimates.

Savings from the engineering desk review widely varied from the ex ante (modeled) savings. Ratios of ex ante to engineering review savings varied from 4% (Project 4, kWh savings, Table 4-21) to 857% (Project 3, kW savings, Table 4-22). Various factors may be affecting the comparison, including the following:

- **Baseline Assumptions:** Ex ante modeled savings assumed ER (existing conditions) on all project measures. In many instances, engineering review sources did not differentiate savings between ER and ROB estimates, or used a “blended baseline” for savings calculations. This would mean that the modeled and desk review savings were using different baseline assumptions.
- **Stacking Effect:** Simulation models can account for the combination of installed measures, or a “stacking effect,” whereby the cumulative savings from installing multiple measures is less than the savings from the measures individually. The engineering review did not account for these interactions.
- **Available Data:** In some instances, not all data required for engineering review were available in program tracking data. This included values such as size (capacity), location, and/or pre-existing (baseline) conditions. In these cases, the evaluation team had to make assumptions to estimate savings.

These three factors bias the savings in different directions. For example, using a blended baseline in the engineering review would result in lower savings than a purely ER baseline (as used in the EnergyPro models). The stacking effect, however, would mitigate this effect, and would (typically) result in overestimating savings in the engineering review. These two effects work in different directions, but are also of differing magnitudes. Consequently, they may not be completely offsetting each other. Table 4-21, Table 4-22, and Table 4-23 present the results of the engineering desk review, comparing first year gross kW, kWh and therm savings values, respectively.

Table 4-21: Engineering Desk Review Gross First Year Energy Results, By Project

Project	Ex Ante Savings (kWh)	Desk Review Savings Estimates (kWh)	kWh Savings Ratio
Project 1	435,941	162,137	37%
Project 2	237,371	34,175	14%
Project 3	4,437	3,212	72%
Project 4	352	15	4%
Project 5	0	0	NA
Project 6	1,219	761	62%
Total Sample	679,320	200,300	29%

Table 4-22: Engineering Desk Review Gross First Year Demand Results, By Project

Project	Ex Ante Savings (kW)	Evaluated Savings from Desk Review (kW)	kW Realization Rate (Evaluated/Ex Ante)
Project 1	42.74	7.34	17%
Project 2	71.64	0.02	0%
Project 3	0.23	1.97	857%
Project 4	0.00	3.20	NA
Project 5	0.00	0.00	NA
Project 6	0.00	0.03	NA
Total Sample	114.60	12.56	11%

Table 4-23: Engineering Desk Review Gross First Year Gas Results, By Project

Project	Ex Ante Savings (therm)	Evaluated Savings from Desk Review (therm)	Therm Realization Rate (Evaluated / Ex Ante)
Project 1	13,679	54,191	396%
Project 2	12,115	7,364	61%
Project 3	1,178	805	68%
Project 4	1,209	1,163	96%
Project 5	114	609	535%
Project 6	50	39	79%
Total Sample	28,345	64,171	226%

4.2.4 Consumption Analysis

The primary goal of the consumption analysis was to ensure that the savings assumptions for the projects were within reasonable bounds relative to the annual consumption (gas and/or electric) of the projects. This analysis involved three primary steps: (1) link the billing data back to project data, (2) validate the comprehensiveness of the billing and savings data, and (3) compare the reported savings to actual pre-program billing data. Linking the billing to the tracking data involved using the accountIDs (including serviceaccountID and SAID) and the physical address of the property. In the second step, the team evaluated the completeness of the consumption data as the information pertains to a particular project. As discussed previously, the billing analysis must have complete building usage data in order to accurately incorporate the full impact of the program. If only partial consumption data are available, this analysis may over- or underestimate program impacts, depending on the spaces covered by the analyzed billing data.

Once the evaluation team evaluated billing data completeness, analysts reviewed consumption data from projects for which 100% of consumption information was available.⁴⁵ For these projects, the evaluation team calculated annual savings in two ways. The first and primary approach used 12 months of gas and electric usage before program participation (based on installation date in the tracking database). The second approach, used only as a validation check against the primary approach, used a three-year average (2012—2014). This pre-program consumption was compared with the ex ante annual savings for the project to determine the proportion of consumption represented by the ex ante savings claims.⁴⁶

The first step required billing data to be available. Billing data for each multifamily project were made available to the evaluation team via the CPUC central consumption data repository, managed by DNV-GL. For the SoCalREN projects, only one of the two projects had available billing data. The team received billing data for most of the BayREN projects. To match the project with the billing data, the evaluation team used address, service account (SA_ID) and customer account (accountID) numbers to merge. Each of these parameters provided varying levels of successful merges to the projects. The most successful matches were for address; the least successful were for SA_ID. Note that even though several sites were matched using the accountID or SA_ID that were not matched using the address, none of the billing data for these sites were sufficient to allow benchmarking the savings against the data, and were therefore not included in the remaining analysis. The first step results, billing data matching, are shown in Table 4-24.

⁴⁵ Projects with <100% of consumption data available were excluded from this analysis.

⁴⁶ See www.energysoft.com/Files/Guides/EUC%20MF%20Energy%20Modeling%20Guideline_Version%201.pdf. According to this EnergySoft guide, calibrating the models to utility data is not a program requirement.

Table 4-24: Billing Data Match by REN and Fuel Type

Entity	Total Projects	Address Match	AccountID Match	SA_ID Match
Electric				
SoCalREN	2	1	0	0
BayREN	95	81	28	8
Gas				
SoCalREN	2	0	0	0
BayREN	95	83	27	14

The second step involved assessing the comprehensiveness of the billing and savings data. The primary issue with matching by accountID or SA_ID was that it provided incomplete billing data for the site. There were no projects that included all units by matching via the account or SA_ID. As an example, one-quarter of the address matches also had accountID and one-sixth of address matches had an SA_ID match. Of these matches though, the billing data represented only 24% of the electric billing usage (kWh) based on the three-year average billing data provided. The same for gas usage—of those that matched with the address match, only 55% of the usage was accounted for using these other joins. Furthermore, it was clear from reviewing the billing data that matching usage by account or SA_ID does not make sense. Using one project as an example, the same unit showed three different accounts one year. For other years, there was only a single account, with accounts changing from year to year. This intuitively makes sense because tenants are constantly moving into and out of these sites, and accountIDs will change as a result. If the database were able to track meter numbers for an entire complex, however, program tracking and billing data could be more effectively matched.

To summarize the billing data, each project was rolled up to annual billing, using the projectID. The next step was to ensure that the number of units for each site in the billing data matched or exceeded the number of units associated with each project in the tracking data. The number of units for each site was derived from data provided by the RENs, which included multifamily property details, such as number of units in each building, the number of buildings, and the total number of rooms. If the units matched or exceeded the units listed in the reference file, the team deemed the billing data to be sufficient to compare. Otherwise the site was listed as insufficient and excluded from the analysis. One additional step was to ensure that the energy savings was greater than zero because there were several projects with zero savings depending on the fuel type associated with the project.⁴⁷ Ultimately, the team used 27 electric (out of 81) and 24 gas projects (out of 83) for BayREN and no SoCalREN projects for this consumption analysis (Table 4-25).

⁴⁷ As an example, one site may have received gas (therm) savings for boiler installation but no electric savings; other projects may have received only electric (kWh) savings but no associated gas savings.

Table 4-25: Billing Data Validity Check

Entity	Total Projects Matched	Meet or Exceed Unit Counts?	Savings Greater than Zero
Electric			
SoCalREN	1	0	0
BayREN	81	39	27
Gas			
SoCalREN	0	0	0
BayREN	83	24	24

The third and final step was to compare the savings with the annual usage data by fuel (kWh electric and therm gas usage). To compare usage, the team reviewed the billing data from the 12 months of consumption before the project was installed.⁴⁸ Any project with a savings ratio over 50% was flagged for further scrutiny. In addition, after reviewing the technical memos from each of the RENs as part of the model comparison task, the team also decided to identify those projects that fell below the 10% savings threshold, because that threshold was deemed to be the minimum standard to accept a project for participation in the Multifamily Whole Building program. Table 4-26 reviews the savings-to-usage ratio strata.

Table 4-26: Review of Projects by Savings-to-Usage Ratio

REN	Billing Period	Total Number of Projects Reviewed	Savings to Usage Ratio			
			<10% Savings	10%–19% Savings	20%–50% Savings	>50% Savings
Electric						
BayREN	12 Month Pre-Installation	25	14	8	3	0
Gas						
BayREN	12 Month Pre-Installation	23	5	9	6	3

The electric savings ratios were skewed toward the lower end of the savings strata, with only three sites showing savings ranging from 20% to 50% of annual consumption. The gas savings ratios, however, were significantly greater. Three of the 23 sites (13%) show very high expected savings of more than 50% over pre-program usage, and six projects (25%) showed savings ratios of 20%–50% of pre-program usage. All three of the >50% gas projects were validated against the project detail to ensure that potentially common areas were not excluded. Only one of these

⁴⁸ The team also reviewed the consumption data using three-year averages to ensure the 12-month pre-installation consumption data did not include outliers and found similar conclusions. Sufficient data for all projects, using three-year average of as the denominator, were not available.

three showed potential for having a common area missing from the billing data; in the other two projects all units and common areas were likely accounted for.⁴⁹

On the low end of the savings ratio, although more than half (57%) of electric projects and 21% of gas projects showed savings less than the program threshold of 10%, the program threshold was based on both fuels (i.e., as long as expected savings for either gas or electric exceed 10% of usage than the project should qualify). In total, the evaluation team found three projects with both gas and electric savings below the 10% savings threshold.⁵⁰ It appears, then, that the same number of projects (three) showed abnormally high savings (>50%) and an equivalent number of projects (three) showed abnormally low savings (<10%). This represents almost one-quarter of the projects (six out of 25) with savings ratios outside of reasonable ranges.

4.2.5 Baseline Assessment

The early replacement (ER) phone survey battery in this effort was based on research and lessons learned from a variety of evaluations and TRMs.⁵¹ The ongoing challenge in ER evaluations is finding a balance between the data needed to assess a measure as ER, and that which can be reasonably collected during a phone survey. To achieve that balance, the ER assessment was based on the following five metrics:

- 1) Working status,
- 2) Age,
- 3) Expected remaining life,
- 4) Part of regularly scheduled/government-mandated upgrade, and
- 5) Standard practices during the scheduled upgrade.

Specifically, measures qualified for ER if they were *not* part of a regularly scheduled or government-mandated replacement and if they:

⁴⁹ Even though the evaluation team used a multilevel data-matching approach with the number of units as a proxy for comprehensiveness, there was still the possibility that a common area or other non-tenant-occupied area of the multifamily complex may have been excluded from the billing data received by the team. If indeed projects that are potentially missing units or accounts associated with the complex are included in this analysis, the results would overstate the savings percentage.

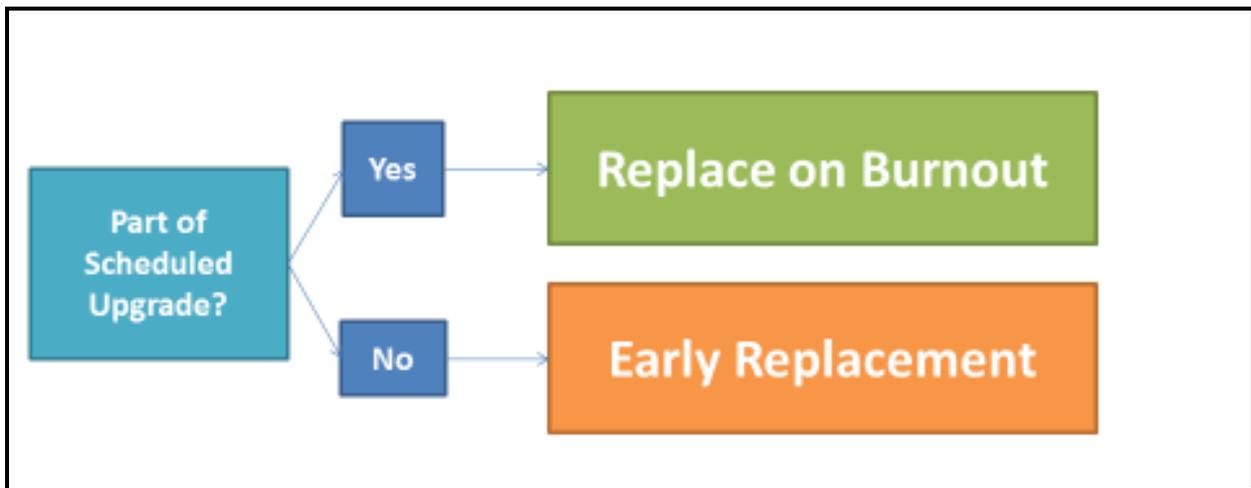
⁵⁰ Note that there were six additional projects with single fuel savings below the 10% threshold and insufficient data to estimate the savings ratio for the other fuel type.

⁵¹ IL TRM. Version 4.0. January 23, 2015; Navigant Consulting, Inc. Home Energy Efficiency Rebate Program. GPY2 Evaluation Report. February 27, 2014; and The Cadmus Group, Inc. 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to Gross, Market Effects, and Equipment Replacement Timing. Volume 1. Part of the Massachusetts Residential Retrofit and Low Income Program Area Evaluation. June 2013.

- Replaced existing equipment,
- Replaced equipment that was functional and in need of only minor repairs (if any), or
- Replaced equipment with self-reported ≥ 2 years left on its expected life.

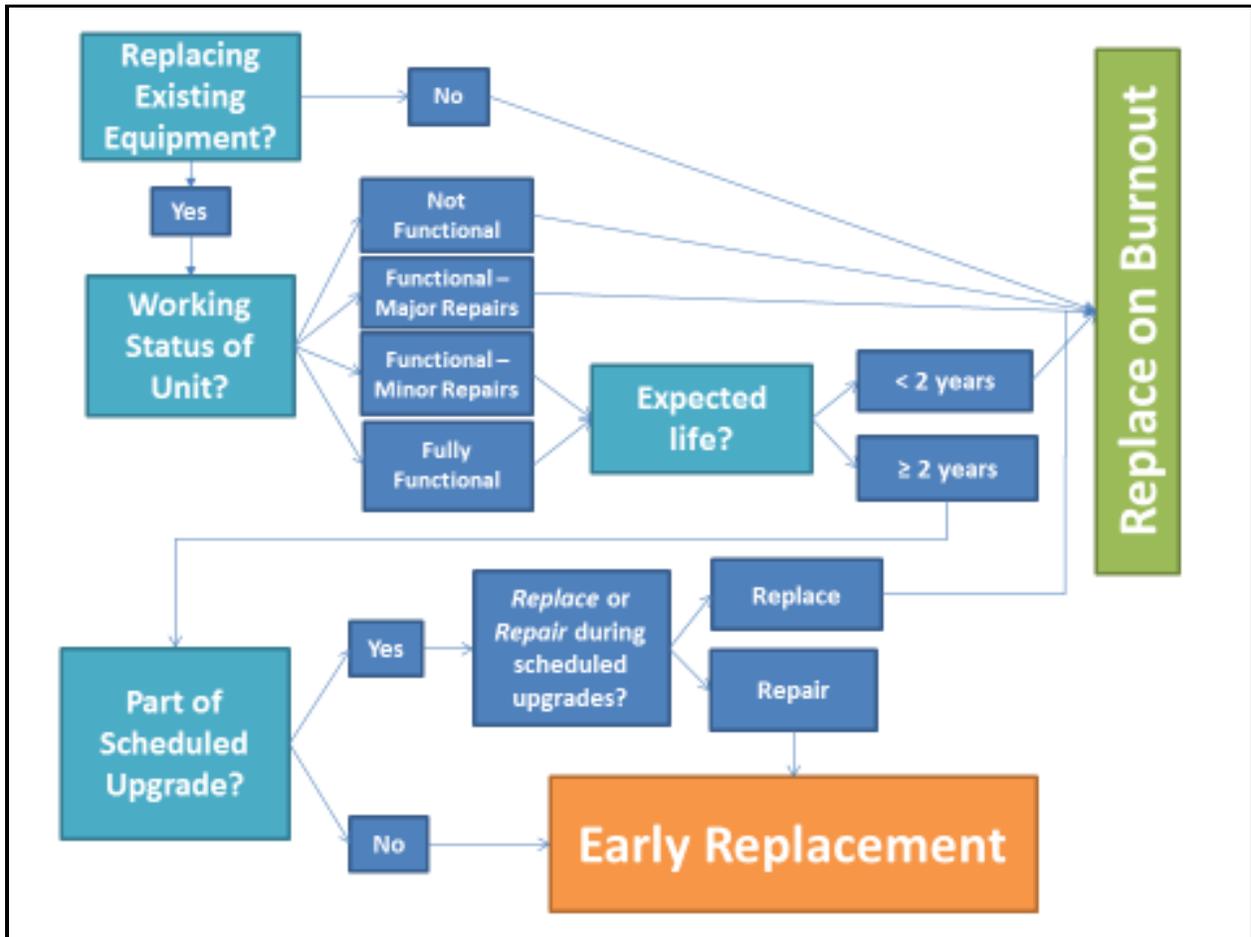
The evaluation team assessed baselines at the measure level to account for the possibility that the likelihood of ER could differ by measure. To derive a single ER estimate for each measure, each project-level measure quantity was used to proportionally weight up to the overall sampled quantity for that measure. For example, lighting and thermostat setback measures were excluded from the baseline analysis and assumed to be ER measures. Windows, roofing, small domestic hot water (DHW; e.g., faucet aerators and low-flow showerheads), and insulation measures were assumed to be ROB unless they were not part of a regularly scheduled, planned, or government-mandated upgrade process. All other surveyed measures required a more detailed ER logic, which factored in working status of the replaced equipment, expected remaining life,⁵² and whether the equipment was part of a regularly scheduled upgrade. Figure 4-1 and Figure 4-2 illustrate the two-tiered ER logic schemes.

Figure 4-1: ER Logic for Small DHW, Roofing, and Shell Measures



⁵² Two years was chosen as the cutoff for remaining useful life because this cutoff is analogous to that often used for FR analysis. It is deemed a reasonable time frame to indicate short-term outlook relative to a less-certain mid-or-long-term time frame.

Figure 4-2: ER Logic for All Other Surveyed Measures



The ER analysis was divided into two distinct groups based on the end-use type. Shell and small DHW measures were included in the first group and all other measures were included in the second group. To derive a single ER estimate for each measure, each project-level quantity was used to weight relative to the overall sampled quantity for that measure.

The program assumes ER savings for all measures, comparing the efficient measure against the efficiency of the existing installed measure/conditions; the results of this analysis, however, demonstrate that because many of the participants had planned upgrades before they participated in the program, the program should be claiming an ROB/new construction baseline rather than an ER baseline. For example, only 48% of the window projects, 67% of the small DHW projects, and 83% of the insulation projects qualified as ER (Table 4-27).

Table 4-27: ER for Shell and Small DHW Measures

Measure Category	Measure(s)	% ER
Shell/Insulation (n = 19)	Insulation (Attic, Wall, Floor, Crawlspace)	83%
Shell/Windows (n = 16)	Windows	48%
Small DHW (n = 41)	Faucet Aerator, Low-Flow Showerhead, Pipe Insulation	67%

For all other measures, respondents were able to provide ER details on all but one-quarter of the surveyed measures (9 of the 36 measures). The sample sizes were small, however, for most of the measure groups, but the results do show that not all projects were ER. For example, while 84% of the large DHW savings came from ER projects (Table 4-28), only 20% of the other DHW were designated ER. Approximately half of non-ER responses resulted from the measure being a new installation (i.e., not replacing existing equipment). The other half was attributable to existing equipment that was either nonfunctional or in need of major repairs.

Table 4-28: ER for Appliances, Large and Other DHW, and Space Heating Measures

Measure Category	Measures	% ER
Appliance (n = 3)	Clothes Washer, Refrigerator	100%
Large DHW (n = 21)	Storage/Tankless/Boiler Water Heaters, Hot Water Demand Control	84%
Other DHW (n = 5)	Water Heater Pump, Water Heater Boiler Controls	20%
Space Heating (n = 3)	Space Heating Boiler, Thermostatic Radiator Valve	100%

The evaluation team used DEER-based EUL as a validity check on the measures listed in Table 4-28. All respondents were asked the age of the equipment and their expectations for the RUL. The average RUL for each measure was then compared against the DEER-based RUL (one-third of the EUL). The tankless water heaters was the measure where the average respondent RUL did not match or exceed the DEER-based RUL, although with an expected RUL of five years, this measure still exceeded the two-year cutoff to be considered an ROB measure. All other measures reviewed in Table 4-28 showed RULs that met or exceeded the DEER-based RUL.

Additionally, the evaluation team reviewed the CPUC tracking databases to assess whether the lifecycle savings correctly accounted for the ER baseline in the REN calculations. Specifically, lifecycle savings for early replacement projects should be calculated using the early replacement baseline for the RUL period, then using a code baseline for the remainder of the EUL, or

$$Lifecycle\ Savings = (RUL * Savings_{ER}) + ((EUL - RUL) * Savings_{Code})$$

To do this, the evaluation team recalculated the lifecycle savings using the data provided in the CPUC tracking database and assessed whether this calculation was followed. As a result, the

evaluation team could not confirm that BayREN is using both the early replacement savings and code savings when calculating lifetime savings. It appears that BayREN is calculating lifecycle savings by multiplying the EUL by first year savings.⁵³ This calculation would over estimate lifecycle savings as it does not account for the replacement of the unit after the RUL. SoCalREN, however, appears to be using the correct calculation (RUL times early replacement baseline savings plus EUL-RUL times code (ROB) baseline savings).

4.3 BayREN and SoCalREN Single Family Measures

The objective of the gross assessment for the BayREN and SoCalREN single family measures was to analyze and compare savings calculations contained in the PA workpapers with the savings reported in the CPUC claimed savings tracking data. More specifically, workpapers were analyzed in order to:

- Assess program documentation quality,
- Assess consistency of assumptions across program administrators,
- Assess measure and package level savings estimates, and
- Assess accuracy of savings claims.

The single family measures are offered under the Home Upgrade Program , which is a whole-house retrofit program administered by IOUs and RENs. PG&E and BayREN offer the Home Upgrade Program in Northern California; and SCE, SCG, SDG&E and SoCalREN offer it in Southern California. During the 2013-14 program period, the RENs offered the Home Upgrade Program component exclusively within their respective territories. However, each IOU offered two package options: Home Upgrade and Advanced Home Upgrade. Home Upgrade is based on savings that are deemed as part of the workpapers.⁵⁴

The workpapers are used to understand the applicable baseline for each building type, home size, and climate zone. An accurate baseline is essential to knowing what can be adjusted to accurately estimate the savings. The evaluation team approached this task first by identifying the appropriate workpapers. As discussed earlier in the section, there were workpaper revisions and EUCA calculator updates that changed throughout the cycle as the program evolved. The team verified the applicable workpaper versions with the respective implementers (PG&E, BayREN, SCE, and SoCalREN).

⁵³ First year savings is calculated only under early replacement baseline conditions.

⁵⁴ Advanced Home Upgrade uses simulation software to model the entire building and estimate savings for each project.

The next step was to review the program activity in the tracking data provided by the CPUC. The IOU tracking data for the 2013-2014 program year changed three times during the analysis period: April, July and September 2015. The findings reported here are based on the September data.

Once the program tracking data were identified, the team attempted to recreate the reported savings using the workpaper equations and assumptions along with the corresponding inputs from the program tracking data. This task was more difficult than first estimated.

Another step of the analysis was to compare the REN savings values with the IOU values to see if there was consistency across the PAs, and help assess the reliability of the values. Because savings varies by climate zone, BayREN was compared to PG&E and SoCalREN was compared to SCE.

During the 2013-14 program years, all four implementers' methods were largely similar conceptually. Each PA modeled prototype buildings but differed on the specific methods used to calculate and report whole house upgrade savings. For example, according to SCE workpaper SCE13M1005, SCE developed savings using the DEER 2011 Single Family Home prototypes to complete base case simulations in eQUEST v3.64. In contrast, SoCalREN used a calibrated EnergyPro model rather than DEER inputs. House characteristics for both PAs were from the Residential Appliance Saturation Survey. In addition, the RENs did not have standardized measure codes thereby making comparisons with the IOUs difficult. The measure codes given by the IOUs relate to a specific code from the workpaper, but the RENs measure codes are a description created by combining measure abbreviations. As a result there were far more measure codes reported by the RENs than by the IOUs. The rest of this section presents findings for BayREN and PG&E first, followed by findings for SoCalREN and SCE.

4.3.1 BayREN and PG&E Workpaper and Tracking Data Comparison

BayREN

BayREN had no workpaper approved by CPUC for the 2013-14 program cycle. The subcontractor that provides program reporting both for BayREN and SoCalREN (BKl), verified that five methods were used to calculate the savings throughout the 2013-14 program period. This consisted of workpapers, calculators or a combination of both. These methods changed as the program evolved and included the following.

- FlexPackage was the name of BayREN's predecessor Home Upgrade suite of programs (<https://www.bayareaenergyupgrade.org/sites/default/files/BayRenHomeUpgradeInfo.PDF>). These early programs were similar in design and the savings estimates were prepared using similar methodology, however each set of calculations for this program was

tailored to the climate zones in which they operated. These can be considered “pre-workpaper” calculations.

- SCE Workpaper SCE13MI005, Revision 0 (Feb. 27, 2012). Overall, this Home Upgrade Program workpaper describes the savings calculation method used in the EUCA Calculator. However, the workpaper document itself does not present deemed values for the packages that could be used to verify the energy savings claim. As a result, there is no standalone workpaper method that is separate from the EUCA Calculator method.
- EUCA Calculator Version 10.
- EUCA Calculator Version 11.

The EUCA V11 model uses DEER building prototypes and weights them using square feet from the Residential Appliance Saturation Survey (RASS) to assign square footage depending on climate zone and vintage. Individual project home square footage is collected but is not provided in the CPUC tracking database.

The measure names reported in the CPUC database are unique and specific for the measure combinations at each site, but omit the methodology, or calculator version, that was used to perform the savings calculation.

PG&E

The measure names from the PG&E workpaper (PGECOALL108, Home Upgrade Program, Revision #0, Sept. 30, 2013) did match CPUC tracking data. In the tracking data, each measure is adjusted based on a combination of climate zone and home vintages based on previously developed model runs. Figure 4-3 shows the variation for one Measure Code - LM 268.

Figure 4-3: PG&E Home Upgrade Program Variations for Measure Code – LM 268

Measure Code	DEERID	Measure Description	Measure Application Type	Building Type	Building Vintag	Climate Zone	1st Baseline			2nd Baseline		
							Kwh Electric Savin	THM Gas Savin	LIFE CYCLE (FUEL # EER)	Kwh Electric Savin	THM Gas Savin	LIFE CYCLE (FUEL # EER)
LM268	IOU WP	62 EF Gas WH	ROB	SFM	75	Z01	0.00	10.70000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	85	Z01	0.00	10.60000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	96	Z01	0.00	10.60000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	75	Z02	0.00	10.10000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	85	Z02	0.00	9.89000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	96	Z02	0.00	10.10000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	75	Z03	0.00	10.10000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	85	Z03	0.00	9.98000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	96	Z03	0.00	10.00000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	75	Z04	0.00	9.98000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	85	Z04	0.00	9.85000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	96	Z04	0.00	9.87000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	75	Z05	0.00	9.99000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	85	Z05	0.00	9.93000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	96	Z05	0.00	9.84000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	75	Z11	0.00	9.78000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	85	Z11	0.00	9.69000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	96	Z11	0.00	9.66000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	75	Z12	0.00	9.93000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	85	Z12	0.00	9.79000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	96	Z12	0.00	9.80000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	75	Z13	0.00	9.34000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	85	Z13	0.00	9.22000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	96	Z13	0.00	9.27000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	75	Z16	0.00	10.80000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	85	Z16	0.00	10.70000	11.0	0.00	0.00000	0.00
LM268	IOU WP	62 EF Gas WH	ROB	SFM	96	Z16	0.00	10.70000	11.0	0.00	0.00000	0.00

BayREN compared with PG&E

As previously described, the evaluation team was provided savings based on measure names in an Excel workbook based on workpaper PGECOALL108, Home Upgrade Program, Revision #0, Sept. 30, 2013. This workpaper includes a calculator also developed by PECCI.

In addition, the evaluation team was provided a similar document with BayREN projects. Neither the workpaper nor calculator addressed home square footage. These are embedded in the savings calculation and driven by vintage and climate zone. The expectation was that if measure codes are the same (or very similar) and given the same vintage and climate zone, the reported savings should be similar.

Overall, the BayREN and PG&E values were the same or similar for the measure the evaluation team was able to compare. There were exceptions however that could not be explained by the available data. Two examples comparing PG&E and BayREN tracking data are provided below.

Example 1: PG&E reported 21 records for measure LM-161 and described it as, “*IFL.AC:R8 DCT INS;6% DCT LKG;SEER 14 AC*”.

BayREN does not reference measure codes but instead provides descriptions. The closest description provided by BayREN to the PG&E measure description is “*AC >= 14 SEER/12*”

EER, DUCT AIR SEALING 6%, FURNACE AFUE >= 92%, DUCT INSULATION". BayREN reported three records – two matched values with PG&E.

Table 4-29 compares the savings reported by each implementer for the given measure using the same assumptions (Climate Zone 12, vintage 1975). Two BayREN records are provided as an example of tracking data. BayREN 1 is aligned with PG&E. BayREN 2 has higher savings than BayREN 1 and PG&E. This may be due to the fact that BayREN 2 represents a two story prototype home instead of a single story home, but this is not evident from the tracking data, is not consistent with the EUCA model output and may simply be an entry error.

Table 4-29: Measure LM-161 Comparison (Average Values from Tracking Data)

Tracking Data Field	BayREN 1	BayREN 2	PG&E
Measure Name	N/A	N/A	LM161
Climate Zone	12	12	12
Measure Type	ER	ER	ER
Square Feet	Unknown	Unknown	Unknown
Vintage	1975	1975	1975
Effective Useful Life (EUL)	18.7	18.6	18.0
Remaining Useful life (RUL)	6.2	6.2	6.0
Installation Rate	0.85	0.85	0.68
Net to gross (NTG)	0.85	0.85	0.85
Realization Rate	0.85	0.85	1.00
Baseline 1 kWh	313.9	728.2	313.9
Baseline 2 kWh	119.3	258.8	119.3
1 st year kWh savings gross	226.8	526.1	212.1
1 st year kWh savings gross no realization rate applied	266.8	526.1	212.1
Lifecycle kWh	2,493.3	5578.3	2,239.9
Lifecycle kWh no realization rate applied	2,933.3	5578.3	2,239.9
Baseline 1 Therms	65.3	104.1	32.5
Baseline 2 Therms	53.9	89.6	21.1

The PG&E and BayREN baseline kWh values match in two of the three BayREN records. The evaluation team could not find any field in the tracking data to explain why one BayREN record is different than the other two. Comparing between PG&E and BayREN there are two main differences. First, the BayREN baseline therms (reported at the bottom of the table) are at least twice as PG&E baseline therms. These should be similar given the same climate zones and not two to three times greater across homes. Second are the assumptions. BayREN reports the same installation rate, NTG and realization rate across projects (0.85). PG&E is consistent internally, reporting the same values for NTG (0.85), realization rate (1.00) and installation rate (0.68). Due

to the differences in realization rates between BayREN and PG&E, first year savings and lifecycle savings differ when the realization rate is applied.

Example 2: PG&E reported 30 records of measure LM-101 and described it as, “*IFL.AC:R30 ATC INS;-15% LKG;R8 DCT INS;6% DCT LKG*”.

BayREN does not reference measure codes but instead provides descriptions. The closest description provided by BayREN to the PG&E measure description is, “*DUCT INSULATION, ATTIC INSULATION, DUCT AIR SEALING 6%, BUILDING AIR SEALING 15%*”. BayREN reported one record for this measure.

The savings reported by BayREN and PG&E for the same vintage and climate zone are very different for electric baselines, but reasonably close for natural gas.

Table 4-30: Comparison of BayREN and PG&E

Tracking Data Field	BayREN	PG&E
Measure Name	N/A	LM101
Climate Zone	12	12
Measure Type	ER	ER
Square Feet	Unknown	Unknown
Vintage	1985	1985
Effective Useful Life (EUL)	16.8	18.0
Remaining Useful life (RUL)	5.6	6.0
Installation Rate	0.90	0.77
Net to gross (NTG)	0.85	0.85
Realization Rate	0.90	1.00
Baseline 1 kWh	-8.6	195.8
Baseline 2 kWh	-14.1	156.1
1 st year kWh savings gross	-7.0	151.0
1 st year kWh savings gross no realization rate applied	-7.7	151.0
Lifecycle kWh	-166.9	2351.2
Lifecycle kWh no realization rate applied	-166.9	2351.2
Baseline 1 Therms	56.9	74.0
Baseline 2 Therms	45.3	59.4

4.3.2 SoCalREN and SCE Workpaper and Tracking Data Comparison

SoCalREN

Like BayREN, SoCalREN had no workpaper approved by CPUC. BKi was interviewed and reported that three methodologies were used to calculate the savings throughout the period including the following.

- 1) SCE Workpaper SCE13MI005, Revision 0 (Feb. 27, 2012). Overall, the statewide Home Upgrade workpaper describes the savings calculation method used in the EUCA calculator. The workpaper document however, does not present deemed values to be reported the energy savings claim. As a result, there is no standalone workpaper method that is separate from the calculator method.
- 2) EUCA Calculator Version 10.
- 3) EUCA Calculator Version 11.

A review of the calculator findings found a calculation error in baseline 2 which has an effect on the savings output for baseline 2 but not on baseline 1 or other aspects of the calculator.

More specifically, there are some single family measures that do not have an applicable code baseline value for the second baseline for cases when the measure is ER. The model should then just assume that the existing baseline is applicable for both baseline values, and they should be set to equal. However, the model appears to be setting the second baseline value to zero, so that the delta wattage is calculated as zero minus the installed wattage, which results in an impact that is equal to the negative value of the annual consumption. Because of this, the lifecycle savings for some measures were extremely highly negative, which had the effect of causing the overall net lifecycle savings for the program to be negative. In instances when this appeared to have occurred, the evaluation team corrected the error by setting the second baseline unit energy savings baseline value equal to the first baseline value. Table 4-31 below summarizes this affect by comparing the reported MW, GWh and MMTherm ex ante savings values, to the corrected values.

Table 4-31: Comparison Between Reported Versus Reviewed Lifecycle MW, GWh and MMTherm Savings for SoCalREN Single Family Measures

Lifecycle Gross Savings	Reported	Reviewed
MW	(0.50)	1.70
GWh	(2.23)	1.10
MMTherms	(0.44)	0.20

It should be noted that there is a version 12 of the EUCA calculator that has rectified this issue. Going forward, the most recent version of the EUCA should be used when reporting annual savings values.

The measure names from the CPUC tracking data mirror the names listed in the workpapers and calculators but did not include certain specific data such as HVAC SEER levels.

The measure codes listed in the tracking data are for combinations of measures at specific sites and do not reflect the SCE workpaper codes.

SCE

- 1) From the Workpaper Archive deeresources.info, we used Workpaper SCE13MI005, Basic Path Enhancement for the Whole House Upgrade Program, Feb. 27, 2012.
- 2) The measure names from the tracking database do match the measure codes in the workpaper.
- 3) The measure codes however do match the workpaper measure codes.
- 4) Savings utilize the MASControl tool, but with an old version (v2.00.10). We did not check the values against this tool since it was not needed to verify if the reported savings methods were the same as SoCalREN.

SoCalREN compared with SCE

There are very few comparison points between SoCalREN and SCE so comparing savings directly was difficult. The evaluation team searched for comparable measure descriptions to provide a comparison. To illustrate the similarities and differences between SoCalREN and SCE four examples are provided.

Example 1: SCE uses Measure Code WB-29806. In the workpaper, the code equates to a description of “*R30 Atc Ins; R13 WI; -15% Lkg; R8 Dct Ins*”.

SoCalREN does not reference measure codes but instead provides descriptions. The closest description provided by SoCalREN to SCE-29806 is “*Attic Insulation and Attic Plane Sealing; Duct Insulation; Duct Replacement; Wall Insulation*”.

Since these descriptions reference similar measures the evaluation team used them as comparison points between SCE and SoCalREN tracking data. The averages across all records for the measure are shown in Table 4-32. Average values vary greatly between the two implementers. Within the SCE program measure WB-29806 first year gross savings ranges from a low for one project of -2,040kWh (negative savings) to 10,258kWh (positive savings) for another. The savings reported by SoCalREN do fall within the relatively wide range of reported SCE values and are similar to multiple SCE projects. There are several differences to note.

- SCE reports vintage as “Ex”. This is a weighted average of homes built from 1978 to 1992 based on RASS data.
- According to the SCE workpaper, EUL should be 17.8 years and RUL 5.9 years. For some measures SCE reports both values as 14 years.
- The SoCalREN EUL and RUL values match the SCE workpaper values.
- NTG ratios are very different between the two implementers. SoCalREN is higher in most cases.
- Realization rates are close, but do not always match. SoCalREN is higher in most cases.

Table 4-32: Measure WB-29806 Comparison (Average Values from Tracking Data)

Tracking Data Field	SoCalREN	SCE
Measure Name	N/A	WB-29806
Climate Zone	9	9
Measure Type	ER ¹	ROBNC
Square Feet	Unknown	Unknown
Vintage	1975	Ex
Effective Useful Life (EUL)	17.7	14
Remaining Useful life (RUL)	5.9	14
Installation Rate	1.00	1.00
Net to gross (NTG)	0.85	0.55
Realization Rate	1.00	0.90
Baseline 1 kWh	610.1	1.0
Baseline 2 kWh	471.0	0.0
1 st year kWh savings gross	610.1	2,212.6
1 st year kWh savings gross no realization rate applied	610.1	2,458.4
Lifecycle kWh	9,157.4	30,976.4
Lifecycle kWh no realization rate applied	9,157.4	34,418.2

¹ For SCE, where measure type is reported as “ER”, the tracking data include the comment, “WP in development” under Measure Description.

Example 2: Another measure for comparison is SCE Measure Code WB-71850. In the tracking data this is described as “-30% Lkg; R8 Dct Ins; 6% Dct Lkg; SEER 14 AC”.

The closest SoCalREN measure description is “Air Conditioner; Whole Building Air Sealing (30% or More Leakage Reduction); Attic Insulation and Attic Plane Sealing; Duct Insulation; Duct Sealing”.

The values for these measures are listed in Table 4-33.

Table 4-33: Measure WB-71850 Comparison (Average Values from Tracking Data)

Tracking Data Field	SoCalREN	SCE
Measure Name	N/A	WB-71850
Climate Zone	9	9
Measure Type	ER	ER
Square Feet	Unknown	Unknown
Vintage	1975	EX
Effective Useful Life (EUL)	14.7	17.3
Remaining Useful life (RUL)	4.9	5.7
Installation Rate	1.00	1.00
Net to gross (NTG)	0.85	0.85
Realization Rate	1.00	1.00
Baseline 1 kWh	944.3	22.1
Baseline 2 kWh	383.5	18.3
1 st year kWh savings gross	944.3	95.8
1 st year kWh savings gross no realization rate applied	944.3	95.8
Lifecycle kWh	8,385.37	1,467.16
Lifecycle kWh no realization rate applied	8,385.37	1,467.16

To determine why these are so different involves investigating the specific details of the measure descriptions for each specific site. These data are outside the tracking data and not available for review.

Example 3: SCE uses Measure Code WB-52042 which is described in the workpaper as “-30% Lkg; R8 Dct Ins; SEER 14 AC; 92 AFUE Furnace”.

SoCalREN does not reference measure codes but the closest description they list is “*Whole Building Air Sealing (15% or More Leakage Reduction); Duct Replacement; Furnace*”.

Both are listed as ER measure application type. The baselines are again not directly comparable and so the savings also are not comparable. It is possible we are comparing the wrong SoCalREN measure but this is the closest one to the SCE description. EUL should be 16.3 and RUL 5.4 according to workpaper. These are reported as 13.0 and 4.3 for SoCalREN and 18.2 and 6.0 for SCE.

Table 4-34: Measure WB-52042 Comparison (Average Values from Tracking Data)

Tracking Data Field	SoCalREN	SCE
Measure Name	N/A	WB-52042
Climate Zone	9	9
Measure Type	ER	ER
Square Feet	Unknown	Unknown
Vintage	1975	Ex
Effective Useful Life (EUL)	13.0	18.2
Remaining Useful life (RUL)	4.3	6.0
Installation Rate	1.00	1.00
Net to gross (NTG)	0.85	0.85
Realization Rate	1.00	1.00
Baseline 1 kWh	315.7	17.4
Baseline 2 kWh	3,694.1	13.0
1 st year kWh savings gross	315.7	69.4
1 st year kWh savings gross no realization rate applied	315.7	69.4
Lifecycle kWh	35,723.3	1,050.2
Lifecycle kWh no realization rate applied	35,723.3	1,050.2

Example 4: SCE uses Measure Code WB-34982 which is described in the workpaper as “*R30 Atc Ins;R13 WI Ins; -15% Lkg;R8Dct Ins; 6% Dct Lkg*”.

SoCalREN does not reference measure codes but the closest description they list is “*Attic Insulation and Attic Plane Sealing; Duct Insulation; Duct Replacement; Wall Insulation*”.

SCE lists the vintage as Ex, and SoCalREN as 1975. The baseline 2 and savings for SCE are listed as “0” and are not comparable with SoCalREN. According to the workpaper, EUL should be 16.4 years and RUL 5.5 years. The tracking data do not match the workpapers and are reported as 14 years and 14 years respectively for SCE and 17.7 years and 5.9 years for SoCalREN.

Table 4-35: Measure WB-34982 Comparison (Average Values from Tracking Data)

Tracking Data Field	SoCalREN	SCE
Measure Name	N/A	WB-34982
Climate Zone	9	10
Measure Type	ER	ER
Square Feet	Unknown	Unknown
Vintage	1975	Ex
Effective Useful Life (EUL)	17.7	14.0
Remaining Useful life (RUL)	5.9	14.0
Installation Rate	1.00	1.00
Net to gross (NTG)	0.85	0.55
Realization Rate	1.00	1.00
Baseline 1 kWh	610.1	92.4
Baseline 2 kWh	471.0	0
1 st year kWh savings gross	610.1	92.4
1 st year kWh savings gross no realization rate applied	610.1	92.4
Lifecycle kWh	9,157.4	1,293.6
Lifecycle kWh no realization rate applied	9,157.4	1,293.6

SCE does not supply natural gas in the region SoCalREN operates in. For a final comparison we reviewed SCG tracking data to compare reported gas savings values with SoCalREN.

Example 5: SCG uses measure code 530600 described in the workpaper as “-30% Lkg;R8 Dct Ins;SEER 14 AC”.

SoCalREN does not reference measure codes. The closest description they list is “Air Conditioner; Whole Building Air Sealing (30% or More Leakage Reduction); Duct Insulation; Duct Replacement”.

SCG reported 339 projects under measure code 530600. The average values for the measure are provided in Table 4-36.

Table 4-36: Measure 530600 Comparison (Average Values from Tracking Data)

Tracking Data Field	SoCalREN	SCG
Measure Name	N/A	530600
Climate Zone	9	9
Measure Type	ER	RET
Square Feet	Unknown	Unknown
Vintage	1975	1975
Effective Useful Life (EUL)	14.3	16.5
Remaining Useful life (RUL)	4.8	0.0
Installation Rate	1.00	1.00
Net to gross (NTG)	0.85	0.85
Realization Rate	1.00	1.00
Baseline 1 therm	69.6	74.4
Baseline 2 therm	57.8	0.0
1 st year therm savings gross	69.6	74.4
1 st year therm savings gross no realization rate applied	69.6	74.4
Lifecycle therm	882.8	1,211.6
Lifecycle therm no realization rate applied	882.8	1,211.6

With the exception of baseline 2 value the measure level therm savings are less than 10% apart for these two implementers.

4.4 Gross Assessment Conclusions and Recommendations

4.4.1 MCE Small Commercial and Multifamily Measures

This section presents conclusions and recommendations related to the findings developed for the gross assessment of MCE's Small Commercial and Multifamily measures. Some of the recommendations are measure or parameter specific, while others address project documentation and data-related issues. Separate recommendations are provided for deemed and calculated measures.

Deemed Commercial and Multifamily Measures

Conclusion Gross-1 [MCE]: MCE did not provide key references for their ex ante assumptions or provide detailed measures descriptions. As part of the data reporting, MCE did not provide adequate references for their deemed measures for all ex ante assumptions in their program tracking data, which could have been either specific references from the DEER or a workpaper. Also, necessary fields from the MCE tracking data that were left blank include RUL ID, EUL ID, NTG ID, ex ante source, version of source, description of source, and measure

code. Furthermore, measure descriptions were not detailed enough to determine baseline conditions or other specifics about the measure being installed. In general, application of evaluation results to tracking data can only be as reliable as the tracking data reported. MCE submitted sufficiently useful information in their tracking data, but without more detailed information and references to ex ante documentation, evaluation updates become limited.

Recommendation Gross-1 [MCE]: MCE should set up an internal process to check the quality and consistency of ex ante data reported to the CPUC and ensure they are providing detailed measure descriptions and references to ex ante assumptions. As part of the data reporting protocol, all PAs should give adequate references for their deemed measures for all ex ante assumptions in their program tracking data. These can either be specific references from the DEER or a workpaper. Even if ex ante data is updated, references provide documentation of which set of ex ante data is being utilized. This provides key information for reporting and evaluations. For the Small Commercial program, MCE should collaborate with PG&E to ensure references to ex ante data are included, develop more descriptive measure names, develop and report consistent measure codes, and provide a clear link to ex ante data. Some specific recommendations include the following: avoid putting measure names in the measure code field and avoid using general values such as “Com” in key fields such as building type. Also, MCE should setup quality control checks to systematically ensure consistency. For example, if two claims are offering identical types of measures with all other factors being the same, then all classifications and numeric values should be consistent.

Conclusion Gross-2 [MCE]: Critical impact parameter fields for savings calculation purposes were not valid or were found to be inconsistent for MCE. In the tracking data, there is a measure application type designation (e.g., ER, ROB) that describes whether a given measure should be calculated with a single baseline or dual baseline. MCE claimed an ER designation for some installations, yet failed to provide second baseline UES values. Furthermore, some numeric impact parameters were found to be null or invalid.

Recommendation Gross-2 [MCE]: MCE should ensure critical fields needed for savings calculations are filled in and valid. For deemed measures, numeric values should be translated directly from the DEER or a workpaper. These ex ante values should be applied systematically to measures of the same type to avoid inconsistencies. It is recommended that MCE calculate out totals to ensure that individual parameters multiply out to be the intended overall amount.

Conclusion Gross-3 [MCE]: Significant variability was found between MCE’s claimed ex ante values, corrected ex ante values, and evaluation values for deemed measures. This lack of consistency seems to suggest an update is needed in the ex ante data for at least the measures reviewed in this analysis to more closely reflect recent evaluation results.

Recommendation Gross-3 [MCE]: Collaboration between all stakeholders (i.e., MCE, PG&E, and CPUC) should work to incorporate evaluation results to update ex ante deemed values. All stakeholders should collaborate to discuss and find the applicability of evaluation results to supplement ex ante data.

Calculated Commercial Lighting Measures

Conclusion Gross-4 [MCE]: MCE's ex ante EULs for LED measures were much greater than evaluated estimates for calculated measures, and EUL estimates were not calculated or documented as part of the project calculation workbooks. The evaluation team found that ex ante EULs for LED measures were 15 years, whereas the evaluated analysis found them to be closer to 10 years. The typical lamp life for an LED lamp is roughly 25,000 hours. Given the 15 year ex ante EUL, that translates over to roughly 1,660 annual hours of operation. Both ex ante and evaluated hours of operation estimates are generally much higher than this. Furthermore, for all measures, the EULs were not calculated as part of the workbook, nor were they documented. EULs are a function of the operating hours for lighting measures, per the DEER methodology.

Recommendation Gross-4 [MCE]: MCE should estimate EULs as part of the calculated application process using site-specific operating hours developed for the project, and DEER based service lives. The DEER methodology should be employed for estimating EULs and site-specific lighting operating hour data should be used when available. For most lighting measures, the EUL is calculated as the service life in hours of the measure retrofitted – which typically represents the lamp life for CFLs and LEDs and the ballast service life for linear fluorescent measures – divided by the evaluated operating hours, or 15 years, whichever is less. If site-specific operating hours are not gathered, DEER EULs should be used, which was not the case for the LED EUL which was set to 15 years.

Conclusion Gross-5 [MCE]: Although MCE's measure installations were provided at the activity area level, all calculated lighting projects used DEER default hours of operation. The evaluated analysis revealed that all lighting projects assume DEER default hours of operation at the building type level. While calculation workbooks disaggregated measure installation into activity areas (i.e., restroom vs. retail sales space), an overall building type hours of operation was applied to every installed measure. The annual hours of use differ based on space type.

Recommendation Gross-5 [MCE]: For calculated measures, MCE should consider either collecting site-specific operating hours that are developed at the activity area in the applications, or applying deemed savings values if they are going to rely on default values. Because MCE is relying on default EUL and operating hours of use, it may be more cost effective to use deemed savings values than using the calculated approach. A hybrid approach

may also be worth considering, where smaller projects use a deemed approach, and larger projects use a calculated approach and are based entirely on site-specific data gathered as part of the application process.

Conclusion Gross-6 [MCE]: MCE's evaluated annual operating hours were generally less than ex ante assumptions for calculated measures. As mentioned above, the ex ante savings values relied on current DEER values. The DEER is in the process of being updated for nonresidential lighting measures. The operating hours and coincidence factors will be based on data collected as part of the 2006-08, 2010-12 and 2013-14 nonresidential lighting impact evaluation studies that have been conducted by the CPUC.

Recommendation Gross-6 [MCE]: For calculated measures, if site-specific operating hours are not collected, MCE should utilize the operating hour and coincidence factor values documented in the 2010-2012 and 2013-2014 nonresidential lighting impact evaluations conducted by the CPUC, which were developed by building type and space type. Results from these studies are readily available, and should be utilized until the revised DEER values are available, which will be based on the data collected from these studies.

Conclusion Gross-7 [MCE]: While ex ante first and second baselines were documented in MCE's calculation workbooks based on an ER or ROB designation, they were provided as annualized savings with no lifecycle estimates. The ex ante lifecycle savings estimates that were reported in the tracking data represent first year savings (first baseline for ER measures or second baseline for ROB measures) multiplied by the EUL. If a measure was determined to be ER within the calculation workbook, those first year savings were multiplied out for the full EUL of the measure.

Recommendation Gross-7 [MCE]: MCE should calculate lifecycle savings for all measures as part of their project calculation workbooks and ensure the calculation is done correctly in their claimed database for ER (or dual baseline) measures, which is (first baseline savings * RUL) + (second baseline savings * (EUL-RUL)). For lighting measures, the EUL would represent the DEER-rated life of the measure divided by the site-specific operating hours as discussed in the above recommendation, and the RUL would represent the calculated EUL divided by 3. If MCE does not calculate lifecycle savings as part of the project calculation workbooks, the calculation used in the claimed database should be corrected. The lifecycle savings, as they are calculated right now, represent an ROB-type savings estimate assuming the baseline wattage is the replaced equipment. This can significantly overstate lifecycle savings.

Conclusion Gross-8 [MCE]. The evaluation team was only able to update roughly 53% of MCE's first year ex ante claim for calculated measures. For several claims, the first year

savings that were reported in the calculation workbooks were different from the claimed first year savings in the tracking data. For a few projects, the evaluation team was able to drag down formulas in Excel that had been previously hard-coded to true up the ex ante claim. However, the evaluation team was not able to successfully complete this exercise for several other projects.

Recommendation Gross-8 [MCE]. MCE’s project calculation workbooks should go through an extensive QC process to validate that the savings estimates in the workbooks are identical to the claimed savings in the tracking data. This effort may include making sure that all lookups are dragged down throughout the workbook and, if hard-coded values are used, there should be a detailed explanation for why they were used. Likewise, when providing applications and workbooks to satisfy a data request, the team putting together the request should make sure that they are providing the evaluation team the final iteration of the calculations. If measures or quantities change from one iteration to another, they should be documented as well.

4.4.2 BayREN and SoCalREN Multifamily Measures

Database Assessment

Conclusion Gross-9 [BayREN, SoCalREN]: The IOU and REN Multifamily Whole Building program tracking data have varying levels of completeness. As examples, PG&E is tracking inadequate levels of data and SDG&E had nearly all required fields.

Recommendation Gross-9 [BayREN, SoCalREN]: IOUs and RENs should adjust data collection and program tracking to ensure all key fields, including participant contact information, measure details, pre-existing conditions, property systems, property details, and utility meter numbers are collected and easily accessible for all completed projects.

Assessment of Savings

Conclusion Gross-10 [BayREN, SoCalREN]: BayREN, SoCalREN, and SDG&E all use different approaches to calculating savings for multifamily measures, and these differences may lead to differences in savings estimates for similar measures. For example, BayREN uses a unique, customized version of EnergyPro called EnergyPro Lite. SoCalREN uses the EnergyPro residential performance module for low-rise buildings. In addition, although both BayREN and SoCalREN use external spreadsheets to calculate savings for selected measures, a review found that they used inconsistent templates with some differences in the assumptions. SDG&E, on the other hand, calculates all savings within EnergyPro.

Recommendation Gross-10 [BayREN, SoCalREN]: The RENs and IOUs should collaborate and agree on consistent methods to estimate savings for similar multifamily measures. This

may include using EnergyPro Lite, which was customized for multifamily complexes, if that is deemed to be the most robust modeling tool. If external spreadsheets are also used, they should be based on consistent templates and assumptions that allow for customization only to account for legitimate drivers of savings differences, such as climate zone.

Conclusion Gross-11 [BayREN, SoCalREN]: Matching BayREN and SoCalREN program data to billing data by different accountIDs was largely unsuccessful, likely because of the high turnover rate for multifamily tenants. Because tenants are constantly moving into and out of these sites, accountIDs will change, making it difficult to match program tracking to billing data. For example, out of 95 BayREN sites that were examined, only 28 sites were matched by accountID. When matched by address, however, billing data for 81 out of 95 sites could be matched successfully.

Recommendation Gross-11 [BayREN, SoCalREN]: The RENs should collect meter numbers for multifamily participants to allow for improved matching of program and billing data. If the database were able to track meter numbers for an entire complex, program tracking and billing data could be more effectively matched at an even higher rate than using an address match. In addition, tracking meter numbers would increase the likelihood that all bills (i.e., from all tenant units and common areas) from each participating building are included in any analysis.

Conclusion Gross-12 [BayREN, SoCalREN]: The inability to calibrate to actual bills for BayREN and SoCalREN multifamily participants may lead to savings estimates that are either overestimated or under the targeted per-project savings threshold for the program. For example, of the 23 sites with claimed gas savings that could be reviewed for the savings versus consumption analysis, three sites had savings that were higher than 50% of pre-program energy use. In addition, the evaluation team found three projects with both gas and electric savings below the 10% savings threshold (the minimum standard to accept a project for participation in the Multifamily Whole Building program).

Recommendation Gross-12 [BayREN, SoCalREN]: The RENs should have access to building level billing data so the savings assumptions and models can be calibrated to actual customer bills. Although having access to project-level billing information has been difficult because privacy and security concerns have prevented the RENs and their implementers from obtaining this information, gaining access to billing data is the most reliable way to estimate savings. If the RENs cannot gain access to customer bills, as an alternative the RENs could share building-level savings estimates with the IOUs who could then calculate, and thus validate, the expected reduction in energy use.

Conclusion Gross-13 [BayREN, SoCalREN]: It was difficult to validate the program claimed savings via an engineering desk review for BayREN and SoCalREN multifamily participants because of factors such as interactive effects, stacking effects, and differences in baseline assumptions. These three factors bias the savings in different directions. For example, using a blended baseline in the engineering review would result in lower savings than a purely ER baseline (as used in the EnergyPro models). The interactive and stacking effects, however, would mitigate this effect, and would (typically) result in overestimating savings in the engineering review. The magnitude of all of these effects, though, is difficult to assess.

Recommendation Gross-13 [BayREN, SoCalREN]: Simulation models would provide a more effective approach to validating the claimed savings for multifamily projects, and site visits would allow verification of the key model inputs. Simulation models would provide a far more rigorous verification of the modeling and savings assumptions. In addition, site visits would provide true verification of model inputs, which—as identified by the single family assessment of EnergyPro—can significantly affect the accuracy of the claimed savings.

Conclusion Gross-14 [BayREN, SoCalREN]: Although the RENs have assumed early replacement savings for all multifamily measures, this research indicated that a substantial portion of projects may not qualify for early replacement because of planned improvements, installation of new equipment, or replacement of equipment that was in poor condition. For example, only 48% of program window replacements, and 67% of faucet aerator and showerhead installations qualified as early replacement measures.

Recommendation Gross-14 [BayREN, SoCalREN]: The RENs should set up a survey for multifamily participants at intake to better determine the appropriate baseline for each project and measure. The intake survey can follow a similar logic as the logic used in this report or that from the CPUC early retirement guidance document,⁵⁵ and the baseline assumptions for a sample of projects should then be verified by an independent third-party evaluator.

Conclusion Gross-15 [BayREN, SoCalREN]: While the RENs have assumed an early replacement baseline on their first year savings for multifamily projects, they are not always calculating lifecycle savings to reflect a change in baseline after the end of the project RUL. For example, BayREN appears to be calculating lifecycle savings using early replacement conditions for the entirety of the project EUL.

⁵⁵ Early Retirement Using Preponderance of Evidence, Version 1.0;
http://www.cpuc.ca.gov/NR/rdonlyres/8AB0DEB5-41B0-4881-BC63-F7EBBEC81318/0/ProjectBasis_EULRUL_Evidencev1July172014.pdf

Recommendation Gross-15 [BayREN, SoCalREN]: The RENs should calculate lifecycle savings for early replacement multifamily projects using the early replacement baseline for the RUL period, then using a code baseline for the remainder of the EUL:

$$\text{Lifecycle Savings} = (RUL * Savings_{ER}) + ((EUL - RUL) * Savings_{Code})$$

Conclusion Gross-16 [BayREN, SoCalREN]: Though the RENs indicated they use project-level savings-weighted EULs (and the associated one-third EUL for the RULs) for multifamily projects, the application of this logic leads to the potential of miscalculation of lifecycle savings and the tracking database did not suggest this logic was actually being implemented. This methodology has the potential for either overstating or understating lifecycle savings. In the example provided in the findings section, using the detailed logic described to the team resulted in a 7% understatement of lifecycle savings. Further, the tracking database showed each project had consistently received an 18 year EUL rather than one based on actual measure installations using the logic described in this report.

Recommendation Gross-16 [BayREN, SoCalREN]: The RENs should be sure to use the correctly weighted and calibrated EUL and RUL for multifamily projects that results in the correct lifecycle savings values, rather than the 18-year EUL currently reported in the tracking database.

4.4.3 BayREN and SoCalREN Single Family Measures

A comparison of workpapers across implementers was possible only at the highest level. The RENs used multiple workpapers and calculators, but the sources of the savings calculations were not mapped back to the source documentation or calculator.

BayREN and PG&E reported similar values in most instances. Where values diverged we could not find an explanation in the existing data. In example 1, the evaluation team suspects the difference in BayREN values could be due to house prototype used (i.e., 1-story vs. 2-story), but that could not be verified.

For SoCalREN and SCE, electric savings values were not comparable. This is surprising since the SCE workpapers were identified as the foundation for the REN workpapers. Since comparisons must be made against measure codes and measure descriptions it is possible that the wrong measure were compared. One cross check is to search for similar baseline 1 savings and review the measure description. A scan of the database revealed that SoCalREN baseline values are several orders of magnitude greater than SCE baseline values.

Another difference was with measure life. The SCE workpapers define RUL as $1/3 * EUL$. This held true for SoCalREN. For SCE records this rule was applied to EUL and RUL when measure application type was ER⁵⁶ (early replacement). For other application types ROBNC and REA (existing equipment) the same value was reported for EUL and RUL.

There are several corrective steps that will make future workpaper reviews more effective. The evaluation team recommends the following.

Conclusion Gross-17 [BayREN, SoCalREN]: The RENs utilized five different sets of workpapers during the 2013-2014 single family Home Upgrade program. IOU workpapers were approved by the CPUC. REN workpapers were not, and this led to multiple revisions as the program evolved or measures changed. Unfortunately the REN tracking data do not include the workpaper source in the “Source Description” field.

Recommendation Gross-17 [BayREN, SoCalREN]: All implementers should use consistent workpapers for the single family Home Upgrade program. If workpapers are not approved by the CPUC, the same set of workpapers should be used throughout the program year. Even when each implementer has different assumptions, approved workpapers provide a structured set of documentation for each program. The version of the workpaper should be part of the project record.

Conclusion Gross-18 [BayREN, SoCalREN]: The most recent version of the EUCA calculator was not being used by the RENs for the single family Home Upgrade program, which resulted in the miscalculation of lifecycle savings.

Recommendation Gross-18 [BayREN, SoCalREN]: The RENs should ensure they are using the most recent approved version of the EUCA calculator for the single family Home Upgrade program, or whatever other tool they are using to develop ex ante savings estimates.

Conclusion Gross-19 [BayREN, SoCalREN]: CPUC tracking data changed over time for the RENs single family Home Upgrade programs. This problem is bigger than only the Home Upgrade program and is being addressed with the data management team. Program data for 2013 and 2014 was first reported in April 2015. The database was not fully populated until after updates in July and again in September.

⁵⁶ The SCE workpaper uses the abbreviation RET for “retrofit”. REA is used for “existing equipment”. ER and ROBNC are not mentioned in the workpaper.

Recommendation Gross-19 [BayREN, SoCalREN]: The RENs should conduct data quality checks quarterly when single family Home Upgrade program data are submitted. A data management plan up front will reduce the nine months it takes for the IOUs to close out program tracking data.

Conclusion Gross-20 [BayREN, SoCalREN]: There were no common measure codes in the workpapers or tracking data across IOU or REN for the single family Home Upgrade programs. This hindered the ability to compare energy savings at the measure or whole house level.

Recommendation Gross-20 [BayREN, SoCalREN]: The RENs should ensure that measure codes represent measures or bundles of measures, and be consistent across implementers for their single family Home Upgrade programs. The IOUs have multiple measure codes to distinguish each measure combination, but the RENs do not. Making the measure codes specific for each implementer and embedding each possible option in a straightforward method to include all data measure necessary to complete a savings calculation.

For example, the evaluation team recommends that methods to calculate and report savings be the same for all program implementers. The first step toward aligning tracking data across implementers is to develop a combination of measure codes that are consistent across implementers. Measure codes could be developed that reflect project elements at the whole-building level. For example “1-WB3-52042-06-1” measure code would mean:

Characteristic/Measure	Code
Implementer (1-5)	1
Single family whole building	WB
Square Feet Bin #	3
R-30 attic insulation	52042
15% building leakage reduction	
R-8 duct insulation	
10% duct leakage	
92 AFUE efficiency furnace	
STV for shower	
Climate zone 6	06
Vintage Bin #1, 2 or 3	1

Any measure code structure similar to this one would create a large number of codes (driven by the number of measure combinations), but would still provide a manageable list of common codes that could be used to streamline future verification activities of CPUC program tracking data.

5

Net-to-Gross Analysis

An NTG analysis was conducted for the commercial measures offered under the MCE program and the BayREN multifamily Whole Building program. A discussion of the approach and resulting NTGRs are presented below.

5.1 MCE Small Commercial Measures

The approach for estimating NTGRs was based on the nonresidential free-ridership approach developed by the NTGR Working Group during the 2010-12 program evaluation cycle and documented in Appendix C, Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers. The NTGR is calculated as the average of three program attribution indices (PAI) known as PAI-1, PAI-2, and PAI-3. Each of these scores represents the highest response or the average of several responses given to one or more questions about the decision to install a program measure. The participant phone survey was the basis for the inputs to each score.

- **Program attribution index 1 (PAI-1)** is a score that reflects the influence of the most important of various program-related elements in the customer's decision to select a given program measure. The PAI-1 score is calculated as the highest program influence factor divided by the sum of the highest program influence factor and the highest non-program influence factor. Some example non-program factors are: previous experience with the measure, recommendation from an engineer, standard practice, corporate policy, compliance with rules or regulations, organizational maintenance or equipment replacement policies and "other – specify." Payback is treated as a program influence factor if the rebate/incentives played a major role in meeting payback criteria, but is treated as a non-program influence factor if it did not play a major role in meeting payback criteria.
- **Program attribution index 2 (PAI-2)** is a score that captures the perceived importance of program factors (including rebate/incentives, recommendation, and training) relative to non-program factors in the decision to implement the specific measure that was eventually adopted or installed. This score is determined by asking respondents to assign importance values to the program and most important non-program influences so that the two total 10. The program influence score is adjusted (i.e., divided by 2) if respondents

had made the decision to install the measure before learning about the program. The final score is divided by 10 to be put into decimal form, thus making it consistent with PAI-1.

- **Program attribution index 3 (PAI-3)** is a score that captures the likelihood of various actions the customer might have taken at the given time and in the future if the program had not been available (the counterfactual). This score is calculated as 10 minus the likelihood that the respondent would have installed the same measure in the absence of the program. The final score is divided by 10 to put into decimal form, thus making it consistent with PAI-1 and PAI-2.

The NTGR is estimated as an average of these three scores. If one of the scores is not available (generally due to respondents giving a “don’t know” or “refusal” response), then the NTGR is estimated as the average of the two available scores. If two or more scores were missing, results are discarded from the calculation.

Table 5-1 presents the NTGRs ratios that were developed for the 2013-14 MCE Small Commercial program, weighted by ex ante gross kWh and kW savings. The resulting values were 0.62 and 0.65, respectively. This compares to ex ante NTGRs of 0.86 and 0.78, respectively. These results were based on a sample size of 20 and had a resulting relative precision of 9% and 7%, respectively, measured at the 90% confidence level.

Table 5-1: MCE Small Commercial NTGRs weighted by kWh and kW

Program	n	Ex ante NTGR kWh	Ex Post NTGR kWh	Relative Precision	Ex ante NTGR kW	Ex post NTGR kW	Relative Precision
MCE Small Commercial	20	0.86	0.62	9%	0.78	0.65	7%

Each of the three equally weighted components comprising the NTGR estimate are shown in Table 5-2. The details behind these estimates are discussed below.

Table 5-2: Three Subcomponents and Overall Free-Ridership

PAI-1 (Influence)	PAI-2 (Relative Importance)	PAI-3 (Install Same Equipment)	Overall NTGR
53%	54%	84%	62%

Table 5-3 compares the results for the 2013-14 MCE Small Commercial program to those developed for the 2010-12 Nonresidential Downstream Lighting and 2013 Nonresidential Deemed ESPI impact evaluations. The 2010-12 study did not include LED measures, so the 2013 LED results are provided. Results are shown by program group, and are weighted by kW and kWh.

Table 5-3: Comparison of NTGRs with 2010-12 and 2013 Evaluations

Evaluation and Program Group	n	NTGR kWh	NTGR kW
2013-14 MCE Small Commercial Program			
Total	20	0.62	0.65
2013 Nonresidential Deemed ESPI Evaluation of LED Measures			
Deemed	46	0.55	0.56
Local Government Partnership/Direct Install	174	0.62	0.61
Third/Local Party Implementer	12	0.60	0.61
Total	232	0.59	0.60
2010-12 Nonresidential Downstream Lighting Study (no LEDs)			
Custom	113	0.50	0.50
Deemed	698	0.60	0.61
Direct Install	326	0.68	0.69
Local Government Partnership	938	0.62	0.61
Third/Local Party Implementer	368	0.60	0.58
Total	2,443	0.61	0.61

Overall, the results compare very well. The MCE result weighted by kWh is one percentage point higher than the overall 2010-12 result and three percentage points higher than the 2013 LED result. The MCE result weighed by kW is four percentage points higher than the overall 2010-12 result and five percentage points higher than the 2013 LED result. However, none of these differences are statistically significant at the 90% confidence level.

5.1.1 Influencing Factors (PAI-1)

Using a 0 to 10 rating scale, where 0 means “not at all important” and 10 means “very important,” program participants were asked to rate the importance of several program and non-program influences on the decision to install a measure. Respondents reported that the availability of the MCE rebate and the payback/return on the project were the two most influential factors, slightly higher than a recommendation by an account representative (Table 5-4). These responses fed into the PAI-1 score.

Table 5-4: Influences on Installation Decisions

Influence on Decision	Type of Influence	Average Importance Score
Availability of the MCE Rebate	Program	9.3
Payback or Return on the Project ¹	Program	9.3
Recommendation by Account Rep	Program	9.1
Other Non-Program Factor	Non-Program	8.1
Age or Condition of the Old Equipment	Non-Program	6.8
Information from the Program or PA	Program	6.5
Information from the Program or PA Training Course	Program	6.2
Standard Practice in the Industry	Non-Program	6.2
Corporate Policy	Non-Program	5.9
Improved Product Quality	Non-Program	5.5
Compliance with Remodeling or Equipment Replacement Practices	Non-Program	3.5
Previous Experience with Energy Efficient Projects	Non-Program	3.0
Previous Experience with [MCE] Program	Non-Program	2.6

¹ If the rebate moved the project within the acceptable payback range, payback was considered a program factor. However, if the project was within the acceptable payback range without the rebate, it was considered a non-program factor.

The PAI-1 score rates program influence as it relates to non-program influences. Specifically, this score is calculated as the maximum program influence score divided by the sum of the maximum program and non-program influence scores, or

$$PAI1 = \frac{Program_{Max}}{Program_{Max} + NonProgram_{Max}}$$

Overall, the PAI-1 score was 5.3, or 53%.

5.1.2 Relative Importance (PAI-2)

For the PAI-2 score, respondents were asked about the relative importance of program and non-program influences on their decision to install a particular measure. Most (13) ranked the importance of program influence as higher than or equal to the importance of the non-program factors. The PAI-2 score is the respondent-provided importance of the program to their decision-making process (Table 5-5).

Table 5-5: Relative Importance of Program and Non-program Influences on Installation Decision

Relative Importance of Factors	Count of Responses
Ranked Program Influences More Important than Non-program Influences	8
Ranked Program and Non-program Influences Equally Important	5
Ranked Non-program Influences More Important than Program Influences	7

Respondents were also asked if they had learned about the MCE program before or after deciding to install the equipment. A response of “after” decreases the measure’s PAI-2 score (and associated NTGR) by half because they were already planning to install the measure before any program intervention. The majority (70%) of respondents indicated that they had learned about the program before deciding to install the equipment. The average PAI-2 score after the adjustment was 5.4, or 54%.

5.1.3 Likelihood of Installing Same Equipment (PAI-3)

The final component of NTG, PAI-3, is related to what equipment would have been installed if the REN program were not available. Using a likelihood scale from 0 to 10, where 0 is “not at all likely” and 10 is “extremely likely,” respondents were asked the likelihood of installing the same efficiency equipment if the REN program were not available. The higher the likelihood of installing the exact equipment, the higher the free ridership (FR), and the lower the NTGR. Respondents, on average, provided a low likelihood of installing the same efficiency equipment in absence of the program, with an average likelihood score of 1.6, resulting in a PAI-3 score of 8.4.

5.2 BayREN Multifamily Measures

The NTG battery used in the participant survey was also based on the NTGR Working Group’s Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers documented in Appendix C, to the extent possible. It is important to note that this is a general framework meant to be adjusted for the individual program needs (as stated on page 1 of that document). The multifamily evaluation, therefore, modified the standards appropriately, particularly because multifamily projects represent a unique “crossroads” of residential and commercial decision making. The team believes that the modifications remain consistent with the intent of the framework.

The decision-maker survey questions were designed to measure the influence of the program on participant decisions to implement program-eligible energy efficiency measure(s). Consistent with the framework and method described above for the MCE Small Commercial analysis, the

surveys scored three different components of program attribution PAI-1 through PAI-3. The NTGR was calculated as an average of these three attribution scores.

Survey respondents were divided into one of two groups: those who believed that the decision-making process was applicable to all measures installed relative to those who believed that the decision-making process was unique for each individual installed measure. For those respondents who believed that the decision-making process was unique for individual measures, the battery of questions was asked for each of three randomly selected measures for that project.

Individual project- and measure-level NTG estimates were weighted to the single, program-level estimate using project- and measure-level savings. To estimate an overall NTGR for participants who answered at the measure level, each measure-specific NTG estimate was weighted according to that measure-specific savings.^{57,58} For the respondents who indicated that their responses applied to all measures in the project, the NTG value was weighted using the ex ante savings claimed for that project.

A total of 43 respondents took part in the survey, with 32 (74% of the respondents) being able to complete the NTG section. The majority of these (28) noted that their responses were indicative of all the installed measures, so that they did not have to provide measure-specific estimates. The overall ex post NTGR for the BayREN multifamily program was 0.58. This compares to an ex ante NTGR of 0.85.

Table 5-6: BayREN Multifamily NTGR weighted by MMBtu

Program	n	Ex ante NTGR	Ex post NTGR	Relative Precision
BayREN Multifamily	32	0.85	0.58	4%

Each of the three equally weighted components comprising the net-to-gross estimate are shown in Table 5-7. The details behind these estimates follow the table.

Table 5-7: Three Subcomponents and Overall Free-Ridership

PAI-1 (Influence)	PAI-2 (Relative Importance)	PAI-3 (Install Same Equipment)	Overall NTGR
51%	40%	83%	58%

⁵⁷ Electric (kWh) and gas (therm) savings were both converted to fuel-neutral MMBtu, derived through the engineering desk review process detailed in Section 4.

⁵⁸ Because the NTGR values for the other installed measures (outside the three that were asked) are unknown, the team believed it proper to attribute the known measure savings only for project-level weighting.

5.2.1 Influencing Factors (PAI-1)

Again, program participants were asked to rate the importance of several program and non-program influences on the decision to install a measure using the same 0 to 10 likelihood scale. Respondents reported that the availability of the REN rebate was slightly more important than the return on the project (Table 5-8). These responses fed into the PAI-1 score.

Table 5-8: Influences on Installation Decisions

Influence on Decision	Type of Influence	Average Importance Score
Availability of the [REN] Rebate	Program	9.6
Payback, or Return on the Project	Non-program	9.1
Feasibility Study, Energy Audit, or Other Types of Technical Assistance Provided by the Program	Program	8.5
Age or Condition of the Old Equipment	Non-program	5.4
Increased Value of Property	Non-program	5.2
Information from Program or Utility Training Course	Program	3.2
Recommendation from an Equipment Vendor	Non-program	4.5
Previous Experience with This Type of Project	Non-program	3.4
Program Marketing Materials	Program	2.3
Compliance with Company’s Normal Maintenance Policies	Non-program	3.1
Utility Account Representative	Program	2.0
Previous Experience with the [REN] Program	Program	1.0

Because most respondents rated the program as equally as important as non-program influences, the PAI-1 score was 5.1, or 51%.

The evaluation team also wanted to ensure that savings were not degraded both for ER and FR in instances where company policy (or perhaps scheduled maintenance) influenced decision making. To do this, the team performed a sensitivity analysis around the influence of a “company’s normal maintenance policies” on the PAI-1 score and found that removing that influence rating did not change the calculated PAI-1 score at all.

5.2.2 Relative Importance (PAI-2)

For the PAI-2 score, most respondents (24) ranked the importance of program influences as higher than or equal to the importance of the non-program factors. The PAI-2 score is the respondent-provided importance of the program to their decision-making process (Table 5-9).

Table 5-9: Relative Importance of Program and Non-program Influences on Installation Decision

Relative Importance of Factors	Count of Responses
Ranked Program Influences More Important than Non-program Influences	14
Ranked Program and Non-program Influences Equally Important	10
Ranked Non-program Influences More Important than Program Influences	10

Respondents were also asked if they had learned about the REN program before or after deciding to install the equipment. Again, a response of “after” decreases the measure’s PAI-2 score by half because they were already planning to install the measure before any program intervention. Nearly all (90%) of respondents indicated that they had learned about the program before deciding to install the equipment. The average PAI-2 score after the adjustment was 4.02, or 40.2%.

5.2.3 Likelihood of Installing Same Equipment (PAI-3)

The final component of NTG, PAI-3, is related to what equipment would have been installed if the REN program were not available. Respondents, on average, provided a low likelihood of installing the same efficiency equipment in absence of the program, with an average likelihood score of 1.7, resulting in a PAI-3 score of 8.3.

5.3 Net-to-Gross Analysis Conclusions and Recommendations

Conclusion Net-1 [MCE, BayREN]: The research found a net-to-gross ratio of 62% for MCE small commercial measures (weighted by evaluated kWh savings) and 58% for BayREN multifamily measures. These values were statistically significantly below the ex ante NTGRs of 86% for MCE small commercial measures (weighted by evaluated kWh savings) and 85% for BayREN multifamily measures. For MCE, the NTGRs were extremely similar to those developed for similar measures in the 2010-12 and 2013 nonresidential lighting CPUC evaluations. For BayREN multifamily measures, the largest contribution to free-ridership was driven by the relative importance and influence of the program in the upgrade choices of decision makers, followed by the relative influence of the most important program-related factor to the most important non-program related factor. For the MCE measures, these two components were nearly identical. For BayREN, several participants with significant savings ranked non-program influences as more important than program influences, which contributed to reducing the program influence scoring. Furthermore, for both sets of measures, participants frequently rated the program as equally as important as non-program factors.

Recommendation Net-1 [MCE, BayREN]: MCE and BayREN should consider using the researched net-to-gross ratio from this study and update them as future evaluation results become available. Because the program is still relatively new, the composition of participants may change over time, so the NTGR may change as the program matures. In addition, the NTGR should be updated if there are changes in the implementation strategies that might reduce or alter the free-ridership (e.g., increasing incentive levels or changing the measure mix). Finally, the MCE results are based on a relatively small sample size, and although the relative precision is high and the results are validated by similar results to recent statewide studies, updating the results with additional sample points would increase the reliability of the values.

6

Cost Effectiveness Analysis

A primary goal of this study was to perform an impact assessment on specific measures offered by the RENs and CCA to develop more reliable estimates of program cost effectiveness. This section presents the final evaluated net savings values and the resulting cost effectiveness analysis utilizing those final evaluated values.

6.1 Final Net Evaluated Savings Values

As discussed in detail in Section 4, evaluated gross savings values were developed for MCE small commercial and multifamily measures. Furthermore, for SoCalREN, corrected ex ante savings values were developed for single family measures. No evaluated gross values were developed for BayREN, or for SoCalREN multifamily measures. Section 5 presents the development of ex post NTGRs for MCE small commercial and BayREN multifamily Whole Building program measures. No ex post NTGR values were developed for MCE multifamily measures, BayREN single family measures, or any SoCalREN measures. Consequently, no evaluation updates were made for SoCalREN multifamily measures and BayREN single family measures; these ex ante values were passed through.

Table 4-8 presents the final reported and evaluated net lifecycle MW, GWh and MMTherms along with the associated net realization rates. Reported savings are generated from the PAs' program tracking data submitted to the CPUC. The negative realization rates for SoCalREN single family measures are a result of the reported savings values being negative, and corrected to be positive. Other than these negative values and the ex ante pass through values for BayREN single family and SoCalREN multifamily measures, realization rates are in the 50-70% for all but MCE multifamily GWhs at 88%.

Table 6-1: Comparison Between Reported Versus Evaluated 2013-14 Net Lifecycle Savings with Net Realization Rates

Program Name	Reported Net Lifecycle			Evaluated Net Lifecycle			Net Realization Rates		
	MW	GWh	MM-Therms	MW	GWh	MM-Therms	MW	GWh	MM-Therms
BayREN-Multifamily	3.0	24.3	2.6	2.1	16.6	1.8	68%	68%	68%
BayREN-Single Family	5.7	1.8	0.7	5.7	1.8	0.7	100%	100%	100%
MCE-Multifamily	0.0	0.6	0.1	0.0	0.5	0.1	70%	88%	89%
MCE-Small Commercial	1.2	9.0	(0.0)	0.7	4.9	(0.0)	61%	55%	52%
SoCalREN-Multifamily	0.4	2.6	(0.0)	0.4	2.6	(0.0)	100%	100%	100%
SoCalREN -Single Family	(0.4)	(1.9)	(0.4)	1.4	0.9	0.2	-342%	-49%	-45%

6.2 Evaluated Cost effectiveness Results

Based on the final evaluated savings values developed for this study, revised cost effectiveness metrics were calculated for the Total Resource Cost (TRC) and the Program Administrator Cost (PAC) ratios, defined as:

$$TRC = \frac{NPV * \sum \text{Avoided Cost}}{\text{Gross Program Cost} + \text{Net Incremental Measure Cost}}$$

$$PAC = \frac{NPV * \sum \text{Avoided Cost}}{\text{Gross Program Cost} + \text{Gross Incentive}}$$

Costs were not broken out by single family and multifamily measures for SoCalREN so only one overall result can be developed.

Table 6-2 presents the projected, reported and evaluated TRC and PAC ratios by program. Projected TRC and PAC values come directly from the PAs’ program implementation plans (PIPs).⁵⁹ Reported TRC and PAC values are generated using the data from the PAs’ program tracking data and program cost information submitted to the CPUC.

⁵⁹ The MCE, BayREN and SoCalREN program implementation plan can be retrieved using the following urls:
http://eestats.cpuc.ca.gov/EEGA2010Files/MEA/PIP/2013/Clean/MEA%20PIP_5%207%2013_final.pdf
http://eestats.cpuc.ca.gov/EEGA2010Files/BayREN/PIP/2013/Clean/A.12-07-001%20Supp%2002_Appendix_A_BayREN_PIP_Revised%20091813%20clean.pdf
http://eestats.cpuc.ca.gov/EEGA2010Files/SoCalREN/PIP/Clean/2014%2002%2014_Amended%20SoCalREN%20PIP_Clean%20Final.pdf

Because the BayREN single family savings values are all ex ante pass through, the evaluated TRC and PAC values are the same as the reported values. Also, the corrected SoCalREN savings values for single family have resulted in positive TRC and PAC values, as expected. Otherwise, evaluated results have changed from reported in roughly the same proportion as the net realization rates presented above. For the most part there was very little program activities and program related costs during the 2013 program year. The MCE small commercial program, did however, have some level of activity that occurred in 2013. Because 2013 was a startup year, the TRC and PAC ratios were also calculated for just the 2014 program year. As shown in Table 6-3, the only values that changed significantly were for the MCE small commercial program. The TRC and PAC ratios increased when looking only at 2014 as expected.

Table 6-2: Comparison Between Projected, Reported and Evaluated TRC and PAC Ratios for the 2013-14 Program Period

Program Name	TRC Ratios			PAC Ratios		
	Projected	Reported	Evaluated	Projected	Reported	Evaluated
BayREN-Multifamily	0.67	0.39	0.28	0.97	0.44	0.30
BayREN-Single Family	0.56	0.05	0.05	1.29	0.06	0.06
MCE-Multifamily	1.06	0.22	0.21	2.42	0.24	0.21
MCE-Small Commercial	1.94	1.10	0.76	9.36	1.28	0.73
SoCalREN-All*	0.74 (elec) 0.51 (gas)	(0.04)	0.02	1.26 (elec) 0.79 (gas)	(0.04)	0.03

*SoCalREN projected separate TRC and PAC Ratios for gas and electric fuels.

Table 6-3: Comparison Between Projected, Reported and Evaluated TRC and PAC Ratios for the 2014 Program Year

Program Name	TRC Ratios			PAC Ratios		
	Projected	Reported	Evaluated	Projected	Reported	Evaluated
BayREN-Multifamily	0.67	0.38	0.27	0.97	0.44	0.30
BayREN-Single Family	0.56	0.05	0.05	1.29	0.06	0.06
MCE-Multifamily	1.06	0.25	0.25	2.42	0.28	0.26
MCE-Small Commercial	1.94	1.52	1.15	9.36	1.95	1.05
SoCalREN-All*	0.74 (elec) 0.51 (gas)	(0.05)	0.03	1.26 (elec) 0.79 (gas)	(0.06)	0.04

*SoCalREN projected separate TRC and PAC Ratios for gas and electric fuels.

6.3 Comparison with IOU Programs

An attempt was made to compare the REN and MCE programs' participation levels, savings values, and resulting TRC and PAC ratios with similar IOU programs. As mentioned in this study, it is difficult to identify similar programs that would make a fair comparison due to the nature of the REN and MCE programs having so many non-resource activities as part of their program delivery. A handful of IOU programs were identified that offer a similar measure mix to a similar classification of customer. Although these IOU programs may not have the same emphasis on marketing, outreach, education and other non-resource activities, it still provides a useful perspective on the performance of the REN and MCE programs, in terms of both the magnitude of participants and savings, on cost effectiveness.

Each of the four IOUs offers a Home Upgrade and Multifamily Whole Building program, which were chosen for comparison for the REN programs as they offer a similar whole building measure to the same customer sectors (single family and multifamily). Unfortunately, those programs do not separate out costs delivered to the single family and multifamily sectors. Therefore, the results shown for these programs combine those two elements.

PG&E offers a number of third party and local government programs, three of which were chosen for comparison to MCE's Small Commercial program based on measure mix and size of the participants (in terms of annual energy consumption). No program was selected for comparison to MCE's Multifamily program due to the inability of identifying a program with a similar measure mix offered to the multifamily sector.

Programs were first identified by those that focused on delivering measures to small commercial customers. As shown below in Table 6-4, approximately 10% of MCE's small commercial participants are medium in size with respect to ex ante gross kWh savings, about a third are small, a third are very small and a quarter are unknown. Therefore, programs were selected such that at least 60% of their savings came from participants in the small and/or very small category, no more than 15% were in the medium category, and no more than 2% in the large category.

Programs were then identified that offered a similar measure mix to those offered by MCE's program. As shown in Table 6-5, 90% of MCE's small commercial ex ante gross kWh savings came from indoor and outdoor lighting measures, and another 10% came from refrigeration measures, with a small fraction of plug load measures. Therefore, programs were selected that had at least 80% of their savings from lighting measures and at least 5% from refrigeration.

The following three programs were identified, whose participant size and end use distributions are all shown in Table 6-4 and Table 6-5:

- PG&E 210113 Energy Fitness Program,
- PGE211012 Madera, and
- PGE2110051 Local Government Energy Action Resources (LGEAR).

Table 6-4: Distribution of Participant Size for MCE’s Small Commercial Program and PG&E’s Comparison Programs

Program ID	Program Name	Site Size	% of Total kWh	Ex Ante Gross kWh Savings
MCE02	SMALL COMMERCIAL	Medium	9.83%	78,783
		Small	31.39%	251,577
		Very Small	31.01%	248,583
		Unknown	27.77%	222,587
PGE210113	ENERGY FITNESS PROGRAM	Large	0.47%	366,542
		Medium	9.09%	7,016,873
		Small	42.01%	32,448,021
		Very Small	42.29%	32,666,086
		Unknown	6.13%	4,736,568
PGE211012	MADERA	Large	1.87%	93,466
		Medium	6.80%	338,996
		Small	48.44%	2,415,196
		Very Small	29.69%	1,480,170
		Unknown	13.20%	658,319
PGE2110051	LOCAL GOVERNMENT ENERGY ACTION RESOURCES (LGEAR)	Large	1.39%	491,981
		Medium	10.84%	3,831,041
		Small	37.32%	13,191,313
		Very Small	23.57%	8,331,509
		Unknown	26.88%	9,502,407

Table 6-5: Distribution of End Use for MCE’s Small Commercial Program and PG&E’s Comparison Programs

Program ID	Program Name	End Use	% of Total kWh	Ex Ante Gross kWh Savings
MCE02	SMALL COMMERCIAL	Indoor Lighting	57.81%	463,380
		Outdoor Lighting	31.92%	255,833
		Plug Loads	0.28%	2,252
		Refrigeration	9.99%	80,065
PGE210113	ENERGY FITNESS PROGRAM	Appliance	0.51%	396,552
		HVAC	0.99%	761,257
		Indoor Lighting	89.75%	69,315,598
		Outdoor Lighting	2.00%	1,543,854
		Plug Loads	0.00%	2,112
		Refrigeration	6.75%	5,214,716
PGE211012	MADERA	Appliance	0.29%	14,508
		HVAC	0.43%	21,469
		Indoor Lighting	80.19%	3,998,249
		Outdoor Lighting	9.45%	471,383
		Refrigeration	9.64%	480,539
PGE2110051	LOCAL GOVERNMENT ENERGY ACTION RESOURCES (LGEAR)	Appliance	0.92%	326,297
		HVAC	1.08%	381,702
		Indoor Lighting	56.65%	20,026,394
		Outdoor Lighting	29.58%	10,456,902
		Plug Loads	0.04%	14,688
		Process	0.26%	91,621
		Refrigeration	11.46%	4,050,646

Table 6-6 presents a comparison of the MCE Small Commercial program and the PG&E small commercial lighting and refrigeration focused programs. Table 6-7 presents a comparison between the REN and IOU Home Upgrade and Multifamily Whole Building Programs. Shown are the number of participants, net lifecycle savings (evaluated for MCE and the RENs, ex ante for the IOUs), and the TRC and PAC ratios.

Table 6-6: Comparison of 2013-14 Savings and Cost Effectiveness among MCE and PG&E Small Commercial Lighting/Refrigeration Programs

Program Name	Number of Participants	Net Lifecycle Savings			Cost Effectiveness	
		MW	GWh	MMTherms	TRC	PAC
MCE-Small Commercial	85	0.7	4.9	(0.0)	0.76	0.73
PGE-Energy Fitness	658	18.4	94.0	(0.3)	1.99	1.99
PGE-LGEAR	4,805	15.6	176.2	(0.5)	0.82	0.88
PGE-Madera	117	1.4	8.4	(0.0)	1.70	1.66

Table 6-7: Comparison of 2013-14 Savings and Cost Effectiveness among REN and IOU Home Upgrade and Multifamily Whole Building Programs

Program Name	Number of Participants	Net Lifecycle Savings			Cost Effectiveness	
		MW	GWh	MMTherms	TRC	PAC
BayREN-Multifamily	95	2.1	16.6	1.8	0.28	0.30
BayREN-Single Family	684	5.7	1.8	0.7	0.05	0.06
SoCalREN-Multifamily	2	0.4	2.6	(0.0)	0.02*	0.03*
SoCalREN - Single Family	120	1.4	0.9	0.2	0.02*	0.03*
PGE-Home Upgrade and MF Whole Building	4,931	86.7	66.7	15.3	0.23	0.83
SCE-Home Upgrade and MF Whole Building	1,700	29.9	22.8	2.0	0.21	0.35
SCG-Home Upgrade and MF Whole Building	2,669	0.0	11.6	4.7	0.24	0.48
SDGE-Home Upgrade and MF Whole Building	642	5.6	4.0	0.6	0.08	0.14

*The SoCalREN TRC and PAC is for their MFM and SFM claims combined. The program costs are not reported by multifamily versus single family in the tracking data, so calculating an individual TRC and PAC was not possible.

Because the REN and MCE programs offer a number of non-resource services, one would expect that the TRC and PAC ratios to be lower relative to the IOU programs. However, these IOU programs provide a reasonable baseline for how cost effective the resource components of these programs could be. If one were to assume a percentage of the REN and MCE program costs were associated with non-resource activities, you could scale the TRC and PAC proportionally to

obtain an estimate of what the TRC and PAC ratios would be for the resource components of their programs. For example, if 50% of the program's cost was associated with non-resource activities, then the program's TRC and PAC ratios could be doubled to estimate what those values would be for just the resource activities.

The MCE small commercial TRC and PAC ratios are less than half the size of the Madera and Energy Fitness programs, but not that significantly different from PG&E's LGEAR program. Looking only at the 2014 program year, however, MCE has a TRC and PAC that are both above 1.0. Participation levels are lower by an order of magnitude compared to the LGEAR and Energy Fitness program, and about half that of the Madera. Given the relatively small service territory of MCE, it should be expected that their participation levels are relatively low. Given the program is still ramping up, we might expect to see increased levels of participation, which could increase their TRC and PAC values, possibly more in line with the average TRC and PAC (of 1.5) of the other three programs. However, as shown above, the LGEAR program has much higher participation levels than the Energy Fitness and Madera programs but has a lower TRC, so higher participation does not necessarily mean a higher TRC. MCE's multifamily program, however has TRC and PAC ratios significantly below 1.0 and there is no clear indication that this program is on a trajectory to become cost effective with respect to these metrics.

The REN and IOU Home Upgrade and Multifamily Whole Building programs all have TRCs in the range of 0.02 and 0.21. Although none of these programs are cost effective in the sense that they have a TRC or PAC ratio greater than 1.0, BayREN's multifamily program is relatively comparable to the other IOU programs and has the highest TRC. The SoCalREN program is driven primarily by single family participants and has TRC and PAC scores similar to BayREN's single family program. Both of these programs have significantly lower TRC and PAC ratios than the IOU programs, however, these programs do not break out single family measures. Therefore, it is difficult to make a direct comparison among single family measures. Note that the TRC and PAC ratios for these programs range from only 0.02 to 0.06, which are significantly lower than the typical TRC and PAC ratios for the other Home Upgrade and Multifamily Whole Building programs.

Although the programs for the RENs and IOUs have TRC and PAC ratios that are significantly below 1.0, the BayREN multifamily program's values are in line with the IOUs. The SoCalREN program, which is primarily single family, and the BayREN single family program have TRC and PAC values that are barely positive, and are significantly lower than the other IOU programs (which do not break out single family and multifamily components).

As the REN and MCE programs are still relatively new, one might expect to see increases in participation, over 2015 and into 2016. This would likely result in an increase in the program's cost effectiveness. Furthermore, if there was a way to quantify the benefits of that the non-resource activities have had on influencing customers to participate in IOU programs and adopt

measures outside of energy efficiency programs, this would also increase the programs' cost effectiveness. It is highly unlikely that the TRC and PAC ratios of the RENs' programs will approach 1.0 given the current values and the values of comparable IOU programs, but they may reach values that are acceptable when considering other objectives that these type of program may be trying to achieve.

As for the MCE program, it is unlikely that the multifamily program will be cost effective in the near term based on current performance. But, the small commercial program has demonstrated in its 2014 program year that it can be cost effective.

6.4 Hard-to-Reach and Depth of Retrofit

Other important aspects to consider regarding these programs outside of a cost effectiveness metric is the ability to serve hard-to-reach (HTR) customer segments, and the depth of retrofit that is achieved by the programs' installations. The RENs and MCE each have a program component that focuses on multifamily customers, which in the past has been identified as an HTR segment. In addition, the MCE small commercial program has served a number of small and very small commercial customers, also an HTR segment. Although these are all important markets to serve, it is not necessarily unique to the statewide portfolio for programs to be targeting these segments. Nevertheless, these programs do help serve hard-to-reach markets to some extent.

Depth of retrofit metrics are meant to identify programs that are more successful in getting customers to install as many energy efficiency measures as possible and not leave energy efficiency opportunities unaddressed. Programs that focus on just the highest impact measures, in other words, those that have missed energy efficiency opportunities, may have higher resulting TRCs (i.e., focus only on lighting measures and ignore other end uses that are less cost-effective). These higher resulting TRCs arise because these programs only address the most-cost effective measures; however they will have a lower depth of retrofit. The Home Upgrade and Multifamily Whole Building programs offered by the RENs offer a whole building approach, which result in a high depth of retrofit, but also have the effect of lower project based cost effectiveness as shown above. The concept however, is to bundle as many measures together to maximize total energy savings, but still have an overall project that is relatively cost effective.

MCE's small commercial program also delivers a wide array of indoor and outdoor lighting measures and some select refrigeration measures. While, this measure mix is not uncommon, MCE was found to install a fewer number of different types of lighting and non-lighting measures than other similar programs offered in PG&E's territory. Table 6-8 provides a comparison of the number of end uses and the number of measure groups that are installed per site on average for MCE's program and the three PG&E programs. Most programs are only

installing a little more than one end use per site, which can be expected given that 80% or more of the energy savings from all of these programs comes from lighting. However, when looking at the number of measure groups per site,⁶⁰ the MCE program installed only 1.3 on average compared to two or more for each of the PG&E programs. However, none of these results show a high level of depth of retrofit relative to all other programs in the statewide portfolio.

Table 6-8: Comparison of Number of End Uses and Measure Groups Installed per Site among MCE and PG&E Small Commercial Lighting/Refrigeration Programs

Program ID	Program Name	End Uses Per Site	Measure Groups per Site
MCE02	SMALL COMMERCIAL	1.2	1.3
PGE210113	ENERGY FITNESS PROGRAM	1.3	2.1
PGE2110051	LOCAL GOVERNMENT ENERGY ACTION RESOURCES (LGEAR)	1.3	2.1
PGE211012	MADERA	1.2	2.0

6.5 Conclusions and Recommendations

Conclusion CostEff-1 [MCE, BayREN, SoCalREN]: The RENs’ and MCE’s tracking data are not in agreement with their 2013-2014 monthly reports. A comparison between the tracking data and the monthly report (2013-2014 inception-to-date fields) showed discrepancies in program expenditures, demand reduction, energy savings, and gas savings. Discrepancies varied from 1% up to 87540%. It was found that RENs/CCA did not always ensure that consistency persisted between annual reports, monthly reports, and tracking data. For example, some costs were included in the annual report, but not in the tracking data.

Recommendation CostEff-1 [MCE, BayREN, SoCalREN]: The RENs and MCE should set up an internal process to ensure that all data sources submitted to the CPUC are in agreement. Sources of resource accomplishments should be in agreement across all data submissions and summary reports. An internal process should be set up to ensure that data reported is being drawn from the same source to prevent discrepancies in summary reports.

Conclusion CostEff-2 [MCE, BayREN, SoCalREN]: The quality of the RENs’ and MCE’s tracking data with respect to cost effectiveness parameters was found to be low. There are many obvious data errors that should be fixed before reporting and submitting to the CPUC. Some quality issues include: program IDs were not always consistent between measure and

⁶⁰ There are seven different lighting measure groups which include CFLs, LEDs, linear fluorescents, controls, HIDs, outdoor and other lighting.

program data, program IDs were not consistent throughout the 2013-14 program cycle, total costs and incentives were filled in when per unit values were expected, both installation rates and realization rates were set to less than one for a particular claim, many claims reported a NTGR equal to one (which is not an approved ex ante value), and many claims reported null NTGRs for non-zero savings. In general, data reporting protocols were not followed and as a result low quality program tracking data was produced.

Recommendation CostEff-2 [MCE, BayREN, SoCalREN]: The RENs and MCE should set up a quality control process where submitted tracking data is run through cost effectiveness to ensure data runs smoothly and the expected TRC and PAC values are returned. This quality control process can reveal a multitude of data reporting errors and should be setup in conjunction with other quality control processes recommended in this report. PAs should run their tracking data through cost effectiveness before submitting to the CPUC, so that confidence can be had of the structure and contents of the data.

Conclusion CostEff-3 [SoCalREN]: SoCalREN combines its single family and multifamily Home Upgrade program elements into a single program, which makes it difficult to assess the cost effectiveness of each element individually.

Recommendation CostEff-3 [SoCalREN]: SoCalREN should consider breaking its single family and multifamily Home Upgrade program elements into two separate programs or else tracking the costs associated with each element separately to allow for each element to be assessed individually for cost effectiveness.

Conclusion CostEff-4 [MCE, BayREN, SoCalREN]: The TRC and PAC cost effectiveness values for the RENs and MCE include costs associated with various non-resource activities within their resource programs that do not directly benefit or support the resource program. Excluding costs that do not directly benefit the resource components of their programs would provide a more accurate and comparable calculation of the cost effectiveness for the resource elements.

Recommendation CostEff-4 [MCE, BayREN, SoCalREN]: The RENs and MCE should consider tracking the costs associated with non-resource activities that do not directly benefit the resource elements of their programs to support a more accurate calculation of cost effectiveness.

7

Non-Resource Assessment

This section of the report presents:

- A verification of non-resource accomplishments of selected programs or service areas offered by BayREN, SoCalREN, and MCE, as stated in their latest Annual Reports,
- Selected non-resource accomplishments presented in the CPUC PY2013-14 Regional Energy Networks Value and Effectiveness Study, conducted by Opinion Dynamics Consulting,⁶¹
- An assessment of the evaluability of selected databases that support these accomplishments based on their quality, completeness, and merging potential,
- The results of data merges between selected non-resource program databases from the above listed Program Administrators (PAs) and CPUC tracking data, and
- A summary of conclusions and recommendations as a result of the findings from the above activities.

The evaluation team submitted data requests to the RENs and MCE, and in response they each sent databases and supporting documentation to confirm the 2013-14 non-resource accomplishments.⁶² In order to evaluate the most current accomplishments, the RENs and MCE were also asked to provide updated values for their non-resource accomplishments through the Second quarter of 2015 and to provide any additional accomplishments and supporting data that could be used to verify them.

Next, a selection of the databases were examined to determine whether they are inclusive of data that would be useful in conducting evaluation studies and whether the data fields are well populated (little to no missing data). The goal of examining the evaluability of these databases is

⁶¹ Prepared by Opinion Dynamics Corporation on behalf of the CPUC. Draft date September 9, 2015. The study was conducted under CPUC Contract 12PS5094 with Itron, Inc. Opinion Dynamics, a subcontractor to Itron for this study, conducted the evaluation plan effort under work order ED_I_LnR_1-1.

⁶² In addition to non-resource accomplishments, a few salient resource program accomplishments listed in the Annual Reports were also verified using CPUC tracking data. These accomplishments mostly address the number of energy upgrade projects completed and total rebates paid for the PAs' residential and nonresidential programs.

to determine how well information related to non-resource accomplishments is documented and whether this information could subsequently be used to track non-resource activities that ultimately lead to energy savings in resource programs. The evaluability of these databases were based on the availability, quality, and completeness of:

- Contact information, such as contact and/or site name, address, phone numbers, and e-mail addresses;
- Merging variables such as electric and/or gas service account IDs, customer IDs, premise IDs or other unique customer data that could be used to merge the datasets to Program Administrator Customer Information Systems (CIS), billing data, and/or CPUC tracking data; and
- Details about recommendations from assessments, suggestions or referrals to programs, or information about attendance at events, workshops, or trainings, depending on the database type.

Last, selected databases from each PA were merged with CPUC tracking data (two to four databases per PA). The purpose of this exercise was to see if participants of the various non-resource program or service activities carried out by the RENs and MCE have led to participation in energy efficiency resource programs. This is one way to gauge how effectively non-resource program activities have led to participation in PA resource programs.

The non-resource accomplishments of the RENs and MCE are taken from their latest Annual Reports.⁶³ Additionally, a listing of accomplishments by the RENs was assembled and presented in a draft study entitled, “CPUC PY2013-2014 Regional Energy Networks Value and Effectiveness Study,” conducted by Opinion Dynamics Consulting. This ODC study did not verify the values it presented, as it was outside the study scope. A majority of these were included in this assessment as well.

Results for the three PAs are presented below with three major subsections:

- Verification of Non-Resource Accomplishments,
- Evaluability of Databases, and
- Results of CPUC Tracking Data Merges.

⁶³ The SoCalREN Annual Report is entitled “2015 SoCalREN Energy Efficiency Annual Report” and dated April 15, 2015. The BayREN Annual Report is entitled “Bay Area Regional Energy Network 2014 Energy Efficiency Annual Report” and dated April 15, 2015. The MCE Annual Report is entitled “2014 MCE Energy Efficiency Annual Report” and though no date appears on its cover page, it was posted to the EEStats website on April 15, 2015. The Annual Reports are available at <http://eestats.cpuc.ca.gov/Views/Documents.aspx>.

The PAs offer multiple programs or services related to single family and multifamily upgrades, small commercial energy upgrades, contractor training, and local marketing and outreach. The non-resource accomplishments for each of these will be discussed within the subsections below, where applicable. Because two statewide studies are being conducted on the Codes & Standards and Financing programs, these program areas are not evaluated in this section of the report. A presentation of non-resource accomplishments for the RENs and CCA in these program areas are included in Appendix B, but are not verified. Additionally, the evaluability of datasets sent to support these program areas was not determined nor were any CPUC tracking data merges conducted with these datasets.

7.1 BayREN

As noted earlier, BayREN offers services in the following four service areas:

- Single Family Home Upgrade,
- Multifamily Upgrade,
- Codes and Standards, and
- Financing.

A verification of non-resource accomplishments is presented below for the Single Family Home Upgrade and Multifamily Upgrade service areas.⁶⁴ Next, an evaluability assessment of the databases provided by BayREN is conducted in which the completeness, quality, and applicability of the data is reviewed. A subset of the 24 files of mixed format (i.e., MS Word, MS Excel, .pdf, and .png) is examined and assessed and are presented after the verification of BayREN's non-resource accomplishments. Last, results from merges of two different non-resource datasets to CPUC tracking data are discussed. These merges were carried out to see if customers who interacted with BayREN went on to participate in any California PA energy efficiency resource programs. The first dataset includes customers who participated in BayREN's Single Family Home Upgrade Advisor program⁶⁵ and the second contains a list of customers who received technical assistance through BayREN's Multifamily Upgrade services.

⁶⁴ The non-resource accomplishments of the Codes and Standards program and the Financing program taken from BayREN's 2014 Energy Efficiency Annual Report are presented in Appendix B and have not been verified.

⁶⁵ The Home Upgrade Advisor service features advisors for individuals, contractor representation and other support as necessary to help homeowners feel supported during the upgrade process.

7.1.1 Verification of Non-Resource Accomplishments

This section presents the verification of selected non-resource accomplishments of BayREN's programs as they were presented in the following:

- BayREN's 2014 Energy Efficiency Annual Report,
- A draft "CPUC PY2013-2014 Regional Energy Networks Value and Effectiveness Study" (referred to hereafter as ODC's Value and Effectiveness Study) conducted by ODC, or
- BayREN's response to the data request submitted by the evaluation team that was used to acquire data to support this impact assessment.

Single Family Home Upgrade

Results of the verification of non-resource accomplishments for the Single Family Home Upgrade service from BayREN's 2014 Annual Report are presented in Table 7-1.

Generally speaking, the evaluation team was able to verify the accomplishments BayREN listed for its Single Family Home Upgrade service area. Except in the case of the Home Upgrade Advisor (HUA) account referrals made to complementary programs (row 2), the numbers of Advanced Home Upgrade audits conducted (row 1), and attendees to Home Upgrade trainings held (row 3) were either the same or greater in quantity in the databases provided by BayREN and used in this verification exercise. Note also that the amount of rebates paid for both Home Upgrade and Advanced Home Upgrade were not verified, as the total rebates paid were not provided (row 1).

An additional accomplishment was provided by BayREN stating that through December 2014, the BayREN Home Upgrade Advisor Program recorded 695 assist contractor cases, comprised of 2,726 individual contractor assistance activities. No verification of this accomplishment occurred because supporting data were not provided by BayREN.

BayREN also provided their accomplishments in 2015 through Q2 and as the last column of the table below shows, BayREN's Single Family Home Upgrade program continued to conduct home upgrades and assessments (a total of 680 projects have been implemented through Single Family Home Upgrade and 434 incentives paid out for Advanced Home Upgrade assessments – see row 1). Home Upgrade Advisor also continued to provide support in 2015 to 713 customers and made referrals to complementary programs to 963 customers (row 2). In addition to the 211 contractors who received Home Upgrade training in 2013-14, BayREN provided training to 62 specialty contractors in Q1 and Q2 of 2015 (row 3).

Table 7-1: Selected BayREN Single Family Home Upgrade Accomplishments from 2014 Annual Report

BayREN SF Home Upgrade Non-Resource Accomplishments for 2013-14 from Annual Report	Verified Accomplishments for 2013-2014	Verified Accomplishments for Q1 and Q2 2015
By December 2014, 1,245 rebates were paid out to 684 Home Upgrade projects and 561 Advanced Home Upgrade Assessment Incentives, for a total of \$1,630,645.50 incentives paid out.	CPUC tracking data show 684 claim IDs (projects) and incentives paid out for these claims equal to \$1,463,950; Data from BayREN ¹ show 561 Advanced Home Upgrade Assessment Incentives paid. According to BayREN, the total incentives paid for these assessments totals \$165,195.50, though the data to verify this were not provided.	CPUC tracking data show a total of 680 claim IDs (projects) for 2015 through Q2. Data from BayREN ¹ shows 434 Advanced Home Upgrade Assessment Incentives paid out in 2015 through Q2. Total incentives for these claims and the audits was not calculated.
Deployment of a Home Upgrade Advisor (HUA) providing both consumer- and contractor-facing support to 549 total accounts; also made 2,012 referrals to complementary programs.	Database from BayREN ² shows 600 qualified accounts ³ and 1,855 general inquiry accounts assisted through Home Upgrade Advisor; a total of 1,030 referrals ⁴ were made to complementary programs.	Database from BayREN ² shows 130 qualified accounts and 583 general inquiry accounts assisted through Home Upgrade Advisor and 963 referrals ⁴ made to complementary programs in 2015 through Q2.
Since implementation, 203 Specialty Contractors have received new Home Upgrade (HU) training	Data from BayREN ⁵ show 221 specialty contractors received HU training	Data from BayREN ⁵ show 62 specialty contractors received HU training

- 1 BayREN provided an Excel file called “Itron_AI_Request_BayREN (1).xlsx” that shows the recipients of Advanced Home Upgrade Assessment Incentives in 2013 through August 2015.
- 2 BayREN provided an Excel file called “BayREN_HUA_All_Accounts.xlsx,” which shows the number of qualified customer accounts that have interacted with the Home Upgrade Advisor program.
- 3 The 600 HUA accounts refer to qualified accounts and include the 549 total accounts that are referred to in the Annual Report, some of which have changed status since the Annual Report was released. Since then, additional accounts created in 2013 or 2014 became qualified single family accounts due to continued follow up and customer engagement.
- 4 BayREN provided an Excel file called “BayREN_HUA_Complementary Program Referrals.xlsx” that lists HUA customers who were referred to complementary programs.
- 5 BayREN provided an Excel file called “Itron_Training_Request_BayREN.xlsx,” which showed contractors trained in a variety of programs, including Home Upgrade.

Table 7-2 presents BayREN’s progress towards meeting the program performance metrics (PPMs) of the Home Upgrade program for 2013-14 as was presented in ODC’s Value and Effectiveness Study. ODC’s study did not attempt to verify the data provided by BayREN, so the evaluation team for this study requested databases to support the results reported by ODC. The evaluation team’s findings are presented in the last two columns of the table.

As Table 7-2 shows, the databases provided by BayREN support the PPMs reported by ODC. When the ODC-reported progress towards PPMs was checked, the evaluation team found that BayREN exceeded the number of trained contractors and the number of Home Upgrade Advisor participants (see rows 1 and 2) than the numbers reported by ODC. The evaluation team was

able to verify the number of projects incented through the Home Upgrade program and the number of audit incentives funded by BayREN⁶⁶ (see rows 3 and 4).

Though the quantities of the last three accomplishments do not match, the numbers retrieved from CPUC tracking data and data provided by BayREN are close to those reported by ODC (rows 5 through 7). ODC's report stated that 92 Home Upgrade Advisor (HUA) participants went on to complete a Home Upgrade project. The evaluation team was able to verify 116 HUA participants who went on to complete a Home Upgrade project (row 5). ODC's report also showed 201 HUA participants who completed an Advanced Home Upgrade project while the evaluation team verified a total of 193 (row 6). Lastly, the number of participating contractors who completed at least one Home Upgrade project is 46 according to ODC's study, while the evaluation team found a total of 52 (row 7). It is possible that these numbers differ slightly because the CPUC tracking database was updated since ODC developed its results. Additionally, Home Upgrade Advisor participant accounts created in 2013-2014 may complete Home Upgrade and Advanced Home Upgrade projects in 2015 and beyond with the ongoing follow up from the Home Upgrade Advisor program, so the project completion numbers may increase with subsequent analyses.

⁶⁶ These line items were already verified in Table 7-1, but are included in this table since it is a replication of the table that appears in ODC's report as Table 18.

Table 7-2: BayREN Home Upgrade Progress by PPM for PY2013-14 (Taken from Table 18 in ODC’s Value and Effectiveness Study)

Program Performance Metrics	2013 Goal	2014 Goal	Accomplished as of December 2014 from ODC Report	Verified as of December 2014	Verified Percent of 2013–2014 Goal Accomplished
Number of trained contractors and real estate professionals ¹	125	125	203 specialty contractors	221	88%
Number of participants in Home Upgrade Advisor Program	500	1,000	549²	2,455³	164%%
Number of units (projects/Claim IDs) incented through Home Upgrade	360	2,142	684	684	27%
Number of audit incentives funded through BayREN ³	586	743	1,245	1,245	93%
Number of Home Upgrade Advisor participants who complete a Home Upgrade project ⁵	75	250	92	116	36%
Number of Home Upgrade Advisor participants that complete an Advance Home Upgrade project ⁵	100	100	201	193	96%
Number of Participating Contractors who have completed one or more Home Upgrade project	30	70	46	52	52%

- 1 While BayREN did propose a Green Labeling program, which the CPUC approved, it did not allocate any funding to this effort in 2013–2014. Accordingly, BayREN did not train any real estate professionals.
- 2 Footnote taken from ODC’s Report: The 2014 Annual Report indicates that 549 customers participated in the Home Upgrade Advisor program; however, according to BayREN staff, BayREN received 2,455 inquiries about the service, which could signify “participation” within the program. Lacking specific guidance on what is considered “participation,” the evaluation team kept the lower value in the table as inquiry does not appear to be full participation.
- 3 Based on a review of the database provided of Home Upgrade Advisor program participants, both qualified customer accounts and general inquiry accounts were considered participants of the program, since one of the purposes of the program is to provide information and services to customers who are trying to determine whether they can participate in the Home Upgrade program.
- 4 BayREN offers an audit rebate of up to a maximum of \$300 for Advanced Home Upgrade and Home Upgrade projects, but does not implement the Advanced Home Upgrade program. BayREN does implement and provide incentives for Home Upgrade projects. BayREN paid 561 audit rebates for Advanced Home Upgrade projects and incentives for 684 for Home Upgrade projects (total of 1,245).
- 5 As reported in BayREN tracking data, the ODC evaluation team received on December 18, 2014.
- 6 This PPM was not in the revised PIPs. However, BayREN indicated that they track these goals and provided progress on these goals directly to ODC.

Multifamily Upgrade

Results of the verification of non-resource accomplishments for the Multifamily Upgrade program from BayREN's Annual Report are presented in Table 7-3. Using CPUC tracking data and databases provided by BayREN, the evaluation team was able to verify almost all non-resource accomplishments listed in its Annual Report.

There was one difference in the reported number of projects completed through the Multifamily Upgrade service offering in the database provided by BayREN and the CPUC tracking data (see row 3, cell 2 of Table 7-3). The number of projects was shown to be 95 in the CPUC tracking data (based on a count of Claim IDs), while BayREN's database showed 125 completed projects, which is the total reported in its Annual Report. The amount of rebates paid out also differed; BayREN stated that a total of \$6.3 million were paid out in incentives for the 125 projects completed, while CPUC tracking data show \$4.3 million paid out for the 95 projects that were claimed in 2013-14. It is not surprising that the total incentives differed across the two data sources since a different number of claims/projects were listed in each. Aside from these differences, the 2013-14 non-resource accomplishments could be verified.

Table 7-3: Selected BayREN Multifamily Upgrade Accomplishments from 2014 Annual Report

BayREN MF Upgrade Non-Resource Accomplishments for 2013-14 from Annual Report	Verified Accomplishments for 2013-2014	Verified Accomplishments for Q1 and Q2 2015
Free technical assistance that provides a customized scope of work, serving approximately 36,031 units in 2013/2014	Data from BayREN ¹ show 36,020 units received free TA	Data from BayREN ¹ show 8,674 units received free TA
Approximately 10,284 units worth of incentives were reserved in 2014	Data from BayREN ¹ show incentives reserved by 10,284 units	Data from BayREN ¹ show incentives reserved by 2,716 units
A total of 8,384 units ² completed upgrades, receiving \$6,287,172.13 in incentives for a total of 125 completed projects in 2014	Data from BayREN ¹ show upgrades completed in 8,384 units for a total of 125 completed projects; CPUC tracking data ³ show 95 claim IDs receiving \$4,269,750 in incentives.	Data from BayREN ¹ show upgrades completed by 125 units for nine projects. CPUC tracking data were not reviewed for claims in 2015 through Q2.
A total of 6,164 units were referred out to other multifamily incentive programs in the Bay Area that were better suited for their scope of work	Data from BayREN ¹ show 6,164 units were referred out to other MF incentive programs.	Data from BayREN ¹ show 1,581 units were referred out to other MF incentive programs in 2015 through Q2.

- 1 BayREN provided data in an Excel file called “BayREN Multifamily TA Accomplishments Database.xlsx” in response to a data request submitted for this impact assessment. This dataset shows multifamily properties and the associated number of units that received technical assistance, site visits, were referred to other programs, reservations for rebates, and energy upgrades.
- 2 The response to the data request notes that there was an error in the number of units that completed upgrades listed in BayREN’s 2014 Annual Report. The actual amount was 8,384 and not 8,834 and this was confirmed in BayREN’s dataset.
- 3 CPUC tracking data were used to check the number of multifamily units that completed upgrades during the 2013-14 program years and to verify the amount of incentives paid out. The incentives paid out do not match across the two data sources, but the number of units receiving upgrades does.

The non-resource accomplishments provided by BayREN for 2015 through Q2 shows continued progress in its Multifamily Upgrade service offering. Data from BayREN allowed a verification of technical assistance provided to 8,674 multifamily units (row 1). It also was able to verify 2,716 reservations for incentives (row 2), upgrades carried out in nine projects that represent 125 multifamily units (row 3), and referrals to 1,581 units to other multifamily incentive programs that would be better suited to them than BayREN’s offering (row 4).

Table 7-4 presents BayREN’s PPMs for the Multifamily Upgrade service area for 2013-14 as was presented in ODC’s Value and Effectiveness Study. This evaluation team’s findings are presented in the last two columns of the table and show that the data presented in ODC’s study could be verified with the databases provided by BayREN. Progress towards meeting the Multifamily PPMs was verified or exceeded the reported progress noted by ODC in all cases.

Table 7-4: BayREN Multifamily Progress by PPM for PY 2013-14 (Taken from Table 20 from ODC Value and Effectiveness Study)

Program Performance Metrics	2013 Goal	2014 Goal	Accomplished as of December 2014 from ODC Report	Verified as of December 2014	Verified Percent of 2013–2014 Goal Accomplished
Number of units receiving technical assistance	3,000	6,000	36,031	36,031	400%
Number of units incented	1,250	3,750	8,384¹	8,384¹	168%
Number of multifamily contractors trained	25	25	20²	20	40%
Number of projects receiving technical assistance	75	150	220	494³	219%
Number of property owners reached by outreach activities	150	150	400⁴	424⁵	141%

- 1 The response to the data request notes that there was an error in the number of units that completed upgrades listed in BayREN’s 2014 Annual Report. The actual amount was 8,384 and not 8,834 and this was confirmed in BayREN’s dataset. An update was made to the number reported by ODC.
- 2 A list of trained multifamily contractors was provided by BayREN in a file called “BayREN Multifamily Contractors Trained Database.xlsx”
- 3 A list of projects receiving technical assistance was provided by BayREN in a file called “BayREN Multifamily TA Accomplishments Database.xlsx”.
- 4 BayREN received interest forms from 400 property owners. Notably, BayREN estimates that they contacted thousands of property owners through various outreach activities. However, they are unable to track this accurately.
- 5 A list of property owners reached by outreach activities was provided by BayREN in a file called “BayREN Multifamily Interest Form Database.xlsx” listed 424 property owners representing 31,333 units.

Codes and Standards

No verification of non-resource accomplishments, evaluability of non-resource program data, or merging of datasets to CPUC tracking data is being conducted for BayREN’s Codes and Standards program. The non-resource accomplishments of the Codes and Standards program can be found in Appendix B.

Financing

No verification of non-resource accomplishments, evaluability of non-resource program data, or merging of datasets to CPUC tracking data is being conducted for BayREN’s Financing programs (e.g., Multifamily Capital Advance, Commercial PACE, and Pay as You Save [PAYS]). The non-resource accomplishments of the Financing programs can be found in Appendix B.

7.1.2 Evaluability of Databases

BayREN provided 12 Excel files that contained the data used to verify the non-resource accomplishments presented in the above subsection. Of these files, a total of four were assessed for quality, completeness, and consistency of:

- Contact information (names, addresses, and phone numbers).
- Merging variables (account numbers and customer IDs), and
- Details about recommendations, referrals, and/or attendance at workshops or events.

A subset of the total number of databases provided was selected because not all of the files would be useful in an evaluation of impacts that stem from non-resource activities. The four files that were evaluated are as follows with descriptions of their contents:

- *Itron_AI_Request_BayREN (1).xlsx*, a database containing 1,065 records of customers who had Advanced Home Upgrade Assessments and received incentives for them from BayREN.
 - The database contains the following key fields: project number, contact, e-mail, phone, PG&E account holder full name, electric provider, electric service account number (electric SAID), gas provider, gas service account number (gas SAID), address, incentive request received date, approved date, paid date, primary contractor name, how important the incentive was (as stated by the customer), and source of awareness (also stated by the customer).
 - The database does contain electric and gas SAIDs, which makes it useful for merging to CPUC tracking data as well as Customer Information System (CIS) data.
 - Variables in the dataset are extremely well populated. Of the 561 assessment incentives paid for 2013-14 (the remaining 504 records are assessments paid in 2015), there are no missing project IDs, no missing names, seven missing e-mail addresses, nine missing phone numbers, no missing electric providers (or associated account numbers), no missing gas service providers, a few missing gas service account numbers, no missing addresses, no missing dates, no missing contractor names, and no missing information about the importance of the incentive and source of awareness.
 - Any recommendations that may be developed as part of the assessments are not being tracked or were not included in the dataset provided.
 - Overall, the key variables necessary for contacting customers in the future and merging to CIS and IOU tracking data are being collected and are well populated. However, no information on recommendations that may be developed as part of the

assessments are being tracked (or if they are, they were not provided when requested as part of the dataset).

- *BayREN_HUA_All_Accounts.xlsx*, a database of 730 qualified accounts and 2,438 general inquiry accounts who have participated in the Home Upgrade Advisor program.
 - Data fields provided in this file are: account ID (internally created by program implementer), created date, created year, date first upgrade completed, first name, last name, phone, e-mail, address, county, account phase (a description of the account's status), and project completed status (including if the customer has participated in the Home Upgrade program or Advanced Home Upgrade program, or taken other actions on their own). There are two tabs in this file. The first lists qualified single family accounts and the second lists general inquiry accounts. The qualified accounts represent participants who have qualified for the Home Upgrade program and have taken the beginning steps of participating in the program. General inquiry accounts include customers who have asked general questions about the program, but are not ready and/or interested in taking the next step towards participating in the Home Upgrade program, not interested in participating, or otherwise not qualified.
 - The total number of qualified 2013-14 accounts listed on tab 1 is 600, and is 130 for 2015 through Q2. The grand total of qualified accounts is 730 from 2013 through Q2 of 2015. Tab 2 shows all general inquiry accounts by created date. The total of 2013-14 general inquiry accounts on tab 2 is 1,855 and for 2015 through Q2 is 583. The grand total of general inquiry accounts is 2,438 from 2013 through Q2 of 2015.
 - There are no service account IDs that can be used to merge to CIS, billing, or CPUC tracking data. There are customer account IDs but these are uniquely created and used by the program implementer.
 - All fields are almost completely populated for the qualified accounts tab. There are no missing account IDs, no missing names, seven missing phone numbers, and 35 missing e-mails. The fields are not as populated for the general inquiry accounts. There are 226 missing names, 440 missing phone numbers, 742 missing e-mail addresses, and 374 missing or incomplete addresses on tab 2.
 - Overall, the key variables necessary for contacting customers in the future are being collected. These variables are well populated for the qualified accounts, but less so for the general inquiry accounts. Service account numbers are not being collected that would allow for a direct merge to CIS and IOU tracking data. The qualified accounts are also being tracked regarding their participation in the Home Upgrade program, Advanced Home Upgrade program, or if other actions were taken on their own.

- *BayREN_HUA_Complementary_Program_Referrals.xlsx*, a database of 1,993 Home Upgrade Advisor participants who have been referred to complementary programs.
 - The database shows a total of 1,030 referrals made in 2013-2014 (the remaining 963 records are referrals that were made in 2015). The fields included in the database are: account ID (contractor assigned and not an IOU service account ID), account record type (whether it was a BayREN general inquiry or BayREN single family qualified account), first name, last name, address, county, opened date, year, and solution title (type of program to which referral was made).
 - There are no service account IDs that can be used to merge to CIS, billing, or CPUC tracking data. There are customer account IDs but these are uniquely created and used by the program implementer.
 - All fields are extremely well populated with very few missing addresses. Note also that all accounts included in this file are found in either the Qualified or General Inquiry Accounts lists in *BayREN_HUA_All_Accounts.xlsx*.
 - Overall, the key variables necessary for contacting customers in the future are being collected and are well populated. Service account numbers are not being collected that would allow for a direct merge to CIS and IOU tracking data. The specific programs to which customers are being referred are also being tracked.
- *BayREN Multifamily TA Accomplishments Database.xlsx*, a database of 633 projects containing just under 44,700 multifamily units that have received technical assistance, were referred out to other programs, received site visits, reserved rebates for the Multifamily program, and completed upgrades through the program.
 - There are a total of 633 rows of data and the fields included are multifamily project ID, project name, address, # of units in building, # of buildings on property, electric SAID, gas SAID, contact name, contact phone, contact e-mail, company account, and date flag (either 2013-2014 or 2015) to indicate whether technical assistance was received, date flag to indicate whether project was referred out, which program the project was referred to, date flag for site visit, date flag for rebate reserved, date flag for upgrade completed, and project scope description.
 - Because the dataset includes electric SAIDs (though only for 130 records) and gas SAIDs (for 120 records), these records can be merged with CPUC tracking data.
 - Most of the customer account fields in the database are extremely well populated. There are no missing multifamily project IDs, 22 missing addresses, 15 missing cities (though in these cases the county is provided), 11 records missing names, 74 missing phone numbers, and 12 missing e-mails; none are missing dates of technical assistance provided.
 - Overall, the key variables necessary for contacting customers in the future are being collected and are well populated. Service account numbers are being collected that

would allow for a direct merge to CIS and IOU tracking data, but not for all customers. Information on recommendations that may be developed as part of the assessments is also being tracked, as are the specific programs to which customers are being referred.

Overall, the databases provided by BayREN are collecting the necessary data to support future evaluations, although a few minor additions could increase their usefulness. Databases where SAIDs are available make it easier to merge them to other data sources that are usable for impact evaluations, such as CPUC tracking data, and utility CIS and billing data. It is recommended that when Home Upgrade Advisor participants become qualified to participate in the Home Upgrade program, their electric and gas SAID be recorded. Also, for customers receiving technical assistance, if recommendations made were tracked, it would allow future evaluators to follow-up on specific actions customers may have taken as a result of the influence of the program. These data are collected for the multifamily assistance efforts but not for the single family Home Upgrade Advisor offering. It is also important to attempt to track when customers go on to participate in IOU programs as a result of BayREN's efforts. This would help support an attribution analysis of the influence of BayREN's efforts on other energy efficiency adoptions that are not made through their programs. While this is happening to some degree (e.g., in the Home Upgrade Advisor), there is potential for improvement in this area. The format of the data collected is consistent and the fields of data collected are appropriate.

7.1.3 Results of CPUC Tracking Data Merges

As mentioned earlier, two non-resource program datasets from each PA were used to merge to the CPUC tracking data to determine whether BayREN customers who have been touched by non-resource program activities, such as audits, marketing, and outreach have gone on to participate in energy efficiency resource programs offered by any of the PAs in California. This is an attempt at linking non-resource activities to participation in programs that have led to energy savings. The two BayREN datasets that were selected for merging are:

- BayREN Single Family Home Upgrade Advisor (HUA) customer data, and
- BayREN Multifamily Technical Assistance data.

Merging BayREN Single Family Home Upgrade Advisor (HUA) Data

The first BayREN dataset to be merged to the CPUC tracking data contains records of customers who participated in BayREN's Single Family Home Upgrade Advisor program.⁶⁷ This program

⁶⁷ BayREN provided an Excel file called BayREN_HUA_All_Accounts.xlsx in response to the evaluation team's data request.

connects BayREN customers to contractors who can provide them with assessments that include recommendations to improve energy efficiency. The data merge was executed to determine whether the program participants took action on the recommendations given by participating in a California PA energy efficiency program.

The customer information came from an Excel workbook provided by BayREN called “BayREN_HUA_All_Accounts.xlsx.” The Excel workbook contains two tabs: (1) General Inquiry Accounts and (2) Qualified Accounts. The General Inquiry Accounts tab includes a list of 2,438 customers that had general questions about the Single Family Home Upgrade program. These are customers that are either not necessarily ready to actually participate in the program, are not interested at the time their inquiry is made, or do not qualify for Home Upgrade. They do receive marketing information about workshops and events and once those who are qualified are ready to engage, they are then listed as a Qualified Account. The number of qualified accounts listed is 730. A customer is considered a Qualified Account when the homeowner is ready to take the next step towards completing a project through the program and is interested in working with an advisor. These customers are all eligible to participate in the program. Interactions with qualified account customers tends to occur more often due to their interest in completing home upgrades. Once an account is classified as a Qualified Account, it does not change back to a General Inquiry Account, even if they do not complete the whole Home Upgrade process.⁶⁸

Both tabs in the Excel workbook list customer information including addresses (street addresses, cities, and zip codes), customers’ first and last names, contact phone numbers, contact e-mail addresses, and the account phase (account phase refers to the stage of the account in the process of program participation). Accounts on both tabs are uniquely identified by an Account ID, which does not provide any link to the CPUC tracking data as these are unique to the program implementer’s data tracking system.

The account phase is a description of the status of the project. Table 7-5 below lists all the values the variable can take. Among the status phases, if a customer is in the “Closed – Retrofit Complete” phase (row in bold in Table 7-5), it is far more likely that the tracking data might have some information on what the customer has implemented as far as energy upgrades are concerned. This is expected because a project has been completed according to the database.

⁶⁸ Description of General Inquiry and Qualified Accounts was provided by BayREN’s Single Family Home Upgrade program implementer CLEAResult.

Table 7-5: BayREN Single Family Home Upgrade Advisor Program Account Phase

Account Phase	Qualified Accounts	General Inquiry Accounts
Assessment Scheduled	4	3
Closed - Homeowner DIY	31	379
Closed - Not Interested in Upgrades	91	969
Closed - Not Qualified	0	686
Closed - Not Responsive	12	46
Closed - Retrofit Complete	423	53
Contractor Bidding	17	2
Contractor Selection	4	29
Education Phase	0	84
In Assessment/Advisor Queue	0	7
On Hold - Scheduled Follow-Up Task	87	100
Planning Phase	12	80
Retrofit in Progress	18	0
Retrofit Scheduled	8	0
Scheduling Contractor	2	0
Upgrade Complete: Finalizing Incentives	12	0
Upgraded & Pursuing Another Upgrade	4	0
Waiting for Assessment Report	5	0
Total	730	2,438

Not surprisingly, Table 7-5 shows that there is a relatively large number of “Closed – Retrofit Complete” accounts in the qualified accounts list (about 60%) than in the general inquiry accounts list (2%). A large proportion of the general inquiry accounts were either not interested in upgrades or not qualified. Therefore, it would be expected that more qualified accounts would be found in the tracking data than the general inquiry accounts.

The BayREN data was merged to the CPUC tracking data by (1) addresses, (2) names, (3) phone numbers, and (4) contact e-mails sequentially. The number of records and number of customers left (as counted based on Account ID) after each step of merging are presented in Table 7-6 and Table 7-7 below for the qualified accounts and general inquiry accounts respectively. After each merge step, the merged records were manually checked to make sure that the site listed in BayREN’s records is the same site as the one merged from the tracking data.

1. Merge by Address: the BayREN Single Family HUA dataset was merged to the CPUC tracking data by addresses. The merge was a valid merge if the two parts had the same city and/or zip code, and if the last name listed in the BayREN SF HUA dataset can be found in the service account name and/or contact name in the tracking data. The names

were manually checked, so that some obviously misspelled names could be merged. A total of 272 qualified accounts and 220 general inquiry accounts were merged.

2. Merge by Name: the BayREN Single Family HUA dataset was merged to the tracking data if the name in the BayREN SF HUA data matched the service account name and/or contact name in the tracking data. The name in the BayREN SF HUA data was constructed as FirstName LastName, and LastName “,” FirstName. The merge was a valid merge if the two parts had the same city and/or zip code, and if the addresses in both datasets match. The addresses were manually checked to ensure that the abbreviations accurately merged to the full word. For example, “123 5th Street” would not be merged to “123 Fifth St.” in the address merge step, but if the names on those records were the same, they would be merged in this step. A total of 52 qualified accounts and 34 general inquiry accounts were merged to the CPUC tracking data.
3. Merge by Phone Number: the BayREN Single Family HUA dataset was merged to the tracking data by contact phone number. The merge was considered a valid merge if the two parts had the same city and/or zip code, and if the addresses in both datasets matched. The addresses were manually checked.
 - a. There were nine merges for nine of the qualified accounts where the address information from one dataset was not available. These were valid merges because they all had matched names and/or e-mails.
 - b. There were 15 merges for four of the general inquiry accounts where the address information from one datasets was not available. Ten merges for three accounts were considered valid because they had matched names. The other five merges were all for one account, where even the name for the record was missing.
4. Merge by E-Mail: the BayREN Single Family HUA dataset was merged to the tracking data by contact e-mail address. The merge was considered valid if the two parts had the same city and/or zip code, and if the addresses in both datasets matched. The addresses were manually checked.
 - a. The qualified account merges were straightforward. There were no addresses missing. Twelve accounts could be merged.
 - b. The general inquiry account merges were not very straightforward. When addresses were missing, the merge was considered valid if the city and/or zip codes were matched. When city and zip codes were both missing along with the addresses, the merge was considered valid if the names could be matched. Only three general inquiry accounts were merged.

Based on the above merging steps, the two parts of each merged record should have same street address (may be differently spelled), same city (may be differently spelled) and/or zip code, and

same last name and/or contact information (phone number and/or e-mail), assuming these variables are populated across both datasets.

Table 7-6: Merging Steps for BayREN Single Family HUA Program Qualified Accounts Database to Tracking Data

Merge Steps	# Obs Left	# Account IDs Left	# Closed – Retrofit Complete Left	% Left	% Complete Left
Raw Data	730	730	423	100%	100%
After Address Merge	458	458	189	63%	45%
After Name Merge	406	406	144	56%	34%
After Phone Merge	397	397	135	54%	32%
After E-Mail Merge	385	385	126	53%	30%

Table 7-7: Merging Steps for BayREN Single Family HUA Program General Inquiry Accounts Database to Tracking Data

Merge Steps	# Obs Left	# Account IDs Left	# Closed – Retrofit Complete Left	% Left	% Complete Left
Raw Data	2,438	2,438	53	100%	100%
After Add Merge	2,218	2,218	39	91%	74%
After Name Merge	2,184	2,184	36	90%	68%
After Phone Merge	2,177	2,177	36	89%	68%
After E-Mail Merge	2,174	2,174	36	89%	68%

The “# Obs Left” column lists the number of observations that could not merge to the tracking data after each attempted step, the “# Account IDs Left” column lists the number of unique accounts, and the “# Closed – Retrofit Complete Left” column lists the number of accounts remaining with account phase being “Closed – Retrofit Complete”. Note that the # Obs Left always equals to # Account IDs Left. This is because the Account ID is a unique identifier of records in the dataset, and making sure that the two columns are the same can serve as a QC for the merging process.

The “% Left” column lists the percentage of observations that could not merge to the tracking data after each type of merge attempt was made, and the “% Complete Left” is the percentage remaining of the accounts with account phase being “Closed – Retrofit Complete”.

Overall, 47% of the qualified accounts (345 out of 730) can be found in the tracking data. This represents 70% of the qualified accounts with account status being “Closed – Retrofit Complete”. On the other hand, only 10% of the general inquiry accounts (264 out of 2,438) successfully merged to the tracking data. This represents 32% of the general inquiry accounts with account status being “Closed – Retrofit Complete”.

Overall, the BayREN Single Family Home Upgrade Advisor program data are complete and consistent. It is not surprising that a large number of qualified accounts were found in the CPUC tracking data as these customers have shown a greater level of interest in program participation and are eligible to participate in the program. It would be easier to work with if:

1. Its address information is formatted better. The data pulls the street address, the city and the zip code together. It took some effort to separate the three parts.
2. The service account IDs are included in the data.

Note that this task merged BayREN’s Single Family Home Upgrade Advisor program records to the whole CPUC tracking database, and it includes all the projects that BayREN’s SF HUA customers completed in 2013-2015 through Q2. These projects may or may not be a consequence of the SF HUA program. To determine which records in the tracking data are related to the SF HUA program, more information is needed.

Summaries of the number of SF HUA qualified account IDs and sites and the number of general inquiry account IDs and sites that merged with resource program claims in the CPUC tracking data can be seen in Table 7-8 and Table 7-9. Note that the number of account IDs that merged to resource claims exceeds those described above (345 qualified accounts and 264 general inquiry accounts) because a single customer may be involved in multiple BayREN and/or PG&E claims.

These tables break down the number of HUA qualified and general inquiry account IDs and sites that merged back up to BayREN claims and the number that merged up to PG&E resource claims as a way to determine how much of an effect BayREN’s Home Upgrade Advisor service has had in leading customers towards PG&E’s Advanced Home Upgrade program versus back to BayREN’s Home Upgrade offering. Because the HUA service was designed to lead customers towards home upgrades, either through BayREN or PG&E for the more customized projects, it is not surprising that 266 customers (representing 359 unique sites) of BayREN’s HUA qualified accounts merged to PG&E records. It is also notable that 252 account IDs (representing 375 sites) were merged to PG&E resource claims.

Table 7-8: Number of BayREN Single Family HUA Program Qualified Account Observations and Sites Merged to Tracking Data

PA	# of Account IDs Merged	# of Sites Merged
BayREN	104	104
PG&E	266	359
Total	370	463

Table 7-9: Number of BayREN Single Family HUA Program General Inquiry Account Observations and Sites Merged to Tracking Data

PA	# of Account IDs Merged	# of Sites Merged
BayREN	13	13
PG&E	252	375
Total	265	388

Merging Multifamily Technical Assistance Data

The customer information for BayREN’s Multifamily Technical Assistance (MF TA) program came from an Excel workbook “BayREN Multifamily TA Accomplishments Database.xlsx” and provides a list of customers who have received technical assistance from BayREN, received a site visit, reserved an incentive, and/or been referred out to other programs. The file lists project ID, street address, city, county, service account IDs, contact name, contact phone number, contact e-mail, etc. There are 633 observations and 597 unique project IDs in the dataset. A total of 36 project IDs have two records with different “Received TA” values, which denotes the CPUC cycle in which the site received technical assistance. This field can take the values “2013-2014” or “2015”. Since this task was to match all possible projects from the tracking data for each BayREN MF site, the merging was completed at the project ID level, ignoring the CPUC cycle in which the TA was received (5) phone numbers, and (6) contact e-mails.

The number of records and number of customers remaining after each step of merging are listed in Table 7-10 below. After each merging step, the merged records were manually checked to make sure that the site listed in BayREN’s records is the same site as the one merged from the tracking data. Note that 161 project IDs merged with records in the CPUC tracking data.

Table 7-10: Merging Steps for BayREN Multifamily TA Program Database to Tracking Data

Merge Steps	# Obs Left	# Unique Project IDs Left	% Obs Left	% Acct Left
RawData	633	597	100%	100%
After Project ID Merge	505	470	80%	79%
After Account ID Merge	496	462	78%	77%
After Address Merge	477	444	75%	74%
After Name Merge	474	441	75%	74%
After Phone Merge	473	440	75%	74%
After E-Mail Merge	469	436	74%	73%

1. Merge by Project ID: BayREN MF TA program data records were merged to the CPUC tracking data by project ID first. A total of 128 observations and 127 unique project IDs

were merged, all to BayREN's tracking records. PG&E's project IDs in the CPUC tracking data were formatted very differently.

2. Merge by Service Account ID: BayREN MF TA program data records were merged to the CPUC tracking data by service account ID. The BayREN MF TA dataset provided both electricity account IDs and gas account IDs, but both ID variables were sometimes confused with the customer account number, which is a completely different identifier. Fortunately, PG&E's service account IDs and their customer account numbers have the same first several digits. Therefore, BayREN MF TA records were merged to the tracking data by the first several digits of the account ID, and then the merged records were checked manually to verify if the two parts had the same addresses. Overall, nine records and eight unique project IDs were merged in this step.
3. Merge by Address: BayREN MF TA program data records were merged to the tracking data by address. BayREN MF TA data also has a project name variable, which sometimes contains address information, though in most cases these were spelled differently than the contents of the address variable for a given record. Therefore, both address and project name were used in the merge. The merge was considered valid if the two parts had the same city and name information. The names from BayREN MF TA records and the tracking data were manually checked to match the names that were differently spelled. Overall, nine observations and eight unique project IDs were merged in this step.
4. Merge by Name: BayREN MF TA program data records were merged to the tracking data by names. The BayREN MF TA data provided two name variables: contact name and account name. The record was merged to the tracking data if either of the variables matched the name variables in the tracking data. Then the merges were checked manually to determine if the addresses were matched. If so, the merge was considered valid. Overall, three observations and three unique project IDs were successfully merged in this step.
5. Merge by Phone Number: BayREN MF TA program data records were merged to the tracking data by phone numbers. Again the merges were checked manually to determine if the addresses matched. Only one observation and one unique project ID merged in this step.
6. Merge by E-Mail Address: BayREN MF TA program data records were merged to the tracking data by e-mail address. Again the merge were checked manually to determine if the addresses matched. Only four observations and four unique project ID were merged in this step.

BayREN Multifamily Technical Assistance program data included a great deal of information, including project IDs and service account IDs, though these are not available for all observations. This greatly aided the merging of the database to the CPUC tracking data. While a substantial

number of variables exist in the database, the information was not very complete. The database would be improved if there was more thorough ID information, address, name, phone number and/or e-mail information. Also, it would be helpful if the zip code were provided. This is because sometimes the city names might be spelled differently, (i.e., “Los Angeles”, “LA”, “L. A.”, etc.). The zip code helps to double check if the matched addresses were indeed the same place.

A summary of the number of BayREN Multifamily TA observations and IDs that merged with resource program claims in CPUC tracking data can be seen in Table 7-11. This table breaks down the number of project IDs and unique sites that merged back up to BayREN claims and the number that merged up to PG&E resource claims as a way to determine how much of an effect the technical assistance provided by BayREN to multifamily customers has had in leading customers towards resource activities offered by the PAs. Based on the findings below, 41 of the 173 project IDs and 79 of the 210 sites were successfully merged to PG&E claims in the tracking data. This shows moderate support for the effect of this non-resource activity on generating energy savings through CA PA energy efficiency programs.

Again, it is important to remember that the number of merged IDs exceeds the number described above (161 IDs) because a single customer may be involved in multiple BayREN and/or PG&E claims.

Table 7-11: Number of BayREN Multifamily TA Program Observations and Sites Merged to Tracking Data

PA	# of IDs Merged	# of Sites Merged
BayREN	132	131
PG&E	41	79
Total	173	210

7.2 SoCalREN

SoCalREN offers services in three major program areas:

- Single Family Home Upgrade and Multifamily Whole Building Upgrade,
- Financing, and
- Southern California Regional Energy Network Public Agency Program (SoCalREC).

A verification analysis of the non-resource accomplishments is presented below for the Home Upgrade program, the Multifamily Whole Building program, SoCalREN contractor trainings, customer outreach, and SoCalREC⁶⁹ among other activities. Next, an evaluability assessment of selected non-resource databases provided by SoCalREN is conducted in which the completeness, quality, applicability of the data is reviewed. A subset of the over 200 files received from SoCalREN of mixed format (i.e., MS Word, MS Excel, and .pdf) were assessed and a selection of datasets that track information about assessments, contractor trainings, and customer support were reviewed in detail for this portion of the assessment. Lastly, merges to CPUC tracking data were carried out using four different non-resource datasets to see if customers who interacted with SoCalREN went on to participate in any California PA energy efficiency resource programs.

7.2.1 Verification of Non-Resource Accomplishments

This section presents the verification of selected non-resource accomplishments of SoCalREN's program areas as listed in:

- SoCalREN's 2015 Energy Efficiency Annual Report;
- ODC's Value and Effectiveness Study; or
- SoCalREN's response to the data request submitted by the evaluation team that was used to acquire data to support this impact assessment.

⁶⁹ The non-resource accomplishments of the Financing program area are taken from SoCalREN's 2015 Energy Efficiency Annual Report and are presented in Appendix B. These accomplishments, like those of RENs' Financing offerings, have not been verified.

SoCalREN Upgrade Component

SoCalREN's set of programs includes the following pilots that were carried out during the 2013-14 program years:

- Home Upgrade,
- Multifamily Program,
- Local Marketing and Outreach,
- Contractor Outreach and Training,
- Green Building Labeling, and
- Low Income Single Family.

Non-resource accomplishments and a verification of them are presented in the following tables for each of these pilot program components launched.

Home Upgrade

In the case of the Home Upgrade program, the evaluation team requested data to attempt to verify one resource accomplishment for the Single Family Home Upgrade program taken from ODC's Value and Effectiveness study. This accomplishment, presented in Table 7-12, states that through its Home Upgrade program, 188 homes or buildings were treated and 506 measures were rebated. In this context, SoCalREN defines "treated" as the number of projects that are in the pipeline. Of these 188 treated homes and buildings, the evaluation team was able to verify 120 completed projects that were rebated through the program using CPUC tracking data.. SoCalREN did note in its response to the evaluation team's data request that 188 was the number of projects active at the time of reporting and that since then, projects have been cancelled or deactivated. This explains why all 188 treated projects were not found in the CPUC tracking data.

SoCalREN also provided a Home Upgrade accomplishment for Q1 and Q2 of 2015, which states that it had 211 active projects representing 1,896 measures. CPUC tracking data shows 122 completed projects in 2015 through Q2. The difference in the number of projects rebated could stem from the fact that projects that are currently active does not mean they have been completed, which is what is shown in the CPUC tracking data.

Table 7-12: SoCalREN Home Upgrade Accomplishment from ODC’s Value and Effectiveness Study

Selected SoCalREN Home Upgrade Non-Resource Accomplishments for 2013-14 from Annual Report and ODC Study	Verified Accomplishments for 2013-2014	Verified Accomplishments for Q1 and Q2 2015
ODC report states that at the end of December 2014, 188 homes and buildings treated and 506 measures were incented or rebated	Data from SoCalREN ¹ and CPUC tracking data both show 120 completed projects/Claim IDs for 2013-14. The number of measures incented was not verified.	Data from SoCalREN ¹ shows 211 buildings (projects) and 1,896 measures that have been submitted and are currently active in 2015 through Q2. CPUC tracking data show 122 completed projects/Claim IDs in 2015 through Q2. The number of measures incented was not tabulated.

1 SoCaREN provided data in an Excel file called “SoCalREN Home Upgrade.xlsx” in response to a data request submitted for this impact assessment.

Multifamily Program

Next, non-resource accomplishments for SoCalREN’s Multifamily program taken from its Annual Report are presented in Table 7-13. The evaluation team was able to verify the number of professional raters that were trained (row 1) and could verify the number of buildings enrolled in the program (row 2). Additionally, data provided by SoCalREN showed that a greater number of assessment incentives were paid out during 2013-14 than their non-resource accomplishment stated (row 3).

Non-resource accomplishments were also provided for the Multifamily program for 2015 through Q2 or were taken from CPUC tracking data. As shown, SoCalREN trained an additional 10 individuals through its Multifamily Existing Building training (row 1) and paid out rebates for seven projects through the program, as the CPUC tracking database shows in row 2 (note that SoCalREN data only show four projects rebated in 2015 through Q2).

Table 7-13: SoCalREN Multifamily Retrofit Accomplishments from 2015 Annual Report and ODC’s Value and Effectiveness Study

Selected SoCalREN Multifamily Non-Resource Accomplishments for 2013-14 from Annual Report and ODC Study	Verified Accomplishments for 2013-2014	Verified Accomplishments for Q1 and Q2 2015
The Multifamily program successfully delivered Multifamily Existing Building Training to 43 professional raters (representing 30 companies).	Data provided by SoCalREN ¹ verified the training of 43 raters representing 32 companies.	Data provided by SoCalREN verified 10 attendees to trainings held in early 2015.
The ODC report provides the number of homes or buildings enrolled (26) as well as the number of units incented or rebated (384) through the Multifamily Retrofits program as of December 2014.	CPUC tracking data shows two ClaimIDs in 2013-14 in a follow up conversation with SoCalREN, it was stated that 26 homes/buildings enrolled but had not completed the process. Also, it was stated that the number of units in the two buildings that completed retrofits is 384. The evaluation team is unable to verify the quantity of units in the two buildings that completed retrofits.	CPUC tracking data shows seven ClaimIDs for 2015 through Q2. However, data provided by SoCalREN ¹ shows four projects that participated in the multifamily retrofits program. There are 457 units in these buildings.
The ODC report notes that through the Multifamily program, 16 projects received a SoCalREN assessment incentive during the 2013-2014 program years comprising 2,037 units as part of the assessment activity.	SoCalREN provided a dataset ¹ that showed 16 properties that received assessments in the 2013-14 program years. .	Data provided by SoCalREN listed 8 properties (with a total of 976 units) that received assessments in 2015.

1 A database of Multifamily Existing Building Training attendees was provided by SoCalREN in an Excel file entitled, “SoCalREN Multifamily.xlsx.” This file includes attendees of trainings that occurred from 2013 through March 2015. It also includes information about buildings and units that received multifamily program assessments that occurred in 2013-14 and about buildings and units that participated in the multifamily program in 2015.

Local Marketing and Outreach

A number of non-resource accomplishments are presented in Table 7-14 for SoCalREN’s Local Marketing and Outreach service area and most of these could be verified using databases provided by SoCalREN. Based on the data provided, the number of homeowner workshops, community events, and individuals assisted through its Home Upgrade Assistance hotline were verified (rows 1 through 3). SoCalREN claimed to have distributed 172 Advanced Home Upgrade coupons, but it did not provide data to verify this. The data it provided only listed the number of paid coupons, which totals 1 in 2014 and none in 2013 (row 4).

In addition to the 2013-14 non-resource accomplishments, SoCalREN provided local marketing and outreach accomplishments that occurred in 2015 through Q2. As shown in the last column of Table 7-14, SoCalREN held 10 workshops to educate homeowners about Home Upgrade programs (row 1), it attended 33 community events to promote its financing and Home Upgrade

services (row 2), it assisted 71 callers through the Home Upgrade Advisor program hotline (row 3), and it recorded the distribution of three Advanced Home Upgrade Coupons (row 4).

Table 7-14: SoCalREN Local Marketing and Outreach Accomplishments from 2015 Annual Report and ODC’s Value and Effectiveness Study

SoCalREN Local Marketing and Outreach Non-Resource Accomplishments for 2013-14 from Annual Report and ODC Study	Verified Accomplishments for 2013-2014	Verified Accomplishments for Q1 and Q2 2015
SoCalREN organized nine homeowner workshops to educate homeowners about building science and Home Upgrade programs, and promote participating contractors. About 150 homeowners attended the workshops.	SoCalREN provided a database ¹ that verifies nine homeowner workshops were conducted in 2014. A total of 150 attendees were listed.	SoCalREN verified that in 2015 to date. ¹ Ten workshops were held to educate homeowners. A total of 65 attendees were listed.
SoCalREN participated in 22 homeowner-facing community events across its service area, promoting financing and single family rebate offerings. ODC’s report presents updated data to show that 27 community events were held and a total of 2,542 direct interactions occurred with individuals at events through the 2013-2014 program years	Data provided by SoCalREN ¹ verifies that it was present at 27 community events where it hosted a booth. A count of direct interactions by event was provided and totaled 2,779.	Data provided by SoCalREN ¹ verified that it was present at 33 community events in 2015 through Q2. A count of direct interactions by event was provided and totaled 4,077.
ODC’s draft report states that 476 residents were assisted through the Home Upgrade Advisor hotline during 2013-2014., and that 172 Advanced Home Upgrade Energy Coupons were issued.	Data provided by SoCalREN ¹ shows that 476 residents were assisted through the HUA hotline in 2013-14. Names of callers and other identifying information were not tracked until after 2/11/2014.	Data provided by SoCalREN shows 71 residents were assisted through the HUA hotline in 2015 through Q2. Names of callers were recorded.
ODC’s draft report states that SoCalREN distributed 172 Advanced Home Upgrade Energy Coupons to individuals.	SoCalREN data ¹ only verifies that coupons were paid to one recipient in 2014. Data do not show how many coupons were distributed	SoCalREN data ¹ only verifies the payment of coupons to three recipients in 2015 through Q2 and does not show how many were distributed.

1 SoCalREN provided an Excel file entitled, “SoCalREN_Local Marketing and Outreach.xlsx” which lists 19 different workshops and their locations. Nine occurred in 2014 and 10 occurred in 2015. The same file provides a list of 27 community events at which SoCalREN hosted a booth to provide information to homeowners and contractors.

Contractor Outreach and Training

A variety of non-resource accomplishments related to Contractor Outreach and Training taken from SoCalREN’s Annual Report and from ODC’s Value and Effectiveness study are presented in Table 7-15 below. Databases provided by SoCalREN were able to verify or show larger numbers of trainings and workshops than were stated in their non-resource accomplishments (rows 1-4) for all except one related to the number of contractors who launched co-op marketing projects (row 5). The accomplishments for 2015 through Q2 were also provided and verified using SoCalREN’s data and these show continued progress in educating and informing contractors about how they can be involved in implementing its programs.

Table 7-15: SoCalREN Contractor Outreach and Training Accomplishments from 2015 Annual Report and ODC’s Value and Effectiveness Study

SoCalREN Contractor Outreach and Training Non-Resource Accomplishments for 2013-14 from Annual Report and ODC Study	Verified Accomplishments for 2013-2014	Verified Accomplishments for Q1 and Q2 2015
The Annual Report notes that SoCalREN began to maintain its own list of contractors in an effort to rebuild a contractor base for its Home Upgrade and Contractor Outreach and Training programs. There were 71 contractors on the list by the end of 2014 (page 4).	Data provided by SoCalREN ¹ show 79 records of trained contractors added in 2013-14.	The dataset provided by SoCalREN verifies an additional 28 contractors on its list that were added in 2015 to date.
SoCalREN hosted six Contractor Recruiting workshops to encourage contractors to participate in Home Upgrade.	SoCalREN provided a database ² of contractor recruiting workshops and a total of six were verified for 2014.	An additional two workshops were held in 2015 by end of Q2.
ODC’s report stated that SoCalREN also provided HVAC Contractor Training, which took two forms: 93 one-on-one trainings with single companies and six event trainings with multiple companies with a total of 206 attendees.	Using data provided by SoCalREN ² , a total of 93 one-on-one trainings and six event trainings were verified. Number of attendees listed was 198.	In 2015, SoCalREN provided 61 one-on-one trainings with 116 attendees ² . The database also shows 17 attendees at contractor workshops (Home Performance Sales Training in May and June).
ODC’s report notes that 473 contractors were assisted via Home Upgrade Advisor during the 2013-2014 program years.	Data verifies 476 contractors assisted through HUA ² , though detailed tracking did not start until 2/11/2014. A total of 321 calls were listed as a total number and no details for these were listed.	Data show 35 contractors assisted through HUA in 2015 through Q2. ²
ODC’s report noted that a total of 48 contractors participated in co-op marketing. It also states that a total of 201 co-op marketing projects were incented.	Data from SoCalREN show ² 40 contractors who participated in co-op marketing projects in 2014 (none in 2013). According to SoCalREN, 8 additional contractors were inducted into the program using ARRA funds. A total of 118 projects were incented as verified by SoCalREN’s data. An additional 83 co-op marketing projects were incented using ARRA funds.	Data show an additional 25 contractors who participated in co-op marketing in 2015 through Q2 ² . A total of 77 projects were incented in 2015.

- 1 SoCalREN provided an Excel file entitled, “SoCalREN_Local Marketing and Outreach.xlsx” which includes the list of contractors maintained by SoCalREN that can provide Home Upgrade services.
- 2 An Excel file from SoCalREN entitled “SoCalREN_Contractor Outreach and Training.xlsx” includes a list of its contractor recruiting workshops, HVAC contractor trainings, contractors who received assistance through Home Upgrade Advisor, and contractors who participated in and were incented for co-op marketing projects.

Green Building Labeling

SoCalREN has implemented a Green Building Labeling program through which it encourages homebuyers to pursue energy efficiency as part of their home purchase at the time of purchase.

As the non-resource accomplishments listed in Table 7-16 show, the training has reached home appraisers and realtors through certification training courses. The data provided by SoCalREN present the number of attendees at the different trainings held through the program, but the non-resource accomplishments speak to the number of attendees who become certified through the trainings. These accomplishments are therefore not verified based on the databases provided by SoCalREN.

Additional accomplishments for 2015 through Q2 were provided in the databases and are presented in the last column of Table 7-16. These show that the Green Building Labeling trainings continue to be held and are well attended.

Table 7-16: SoCalREN Green Building Labeling Accomplishments from 2015 Annual Report

SoCalREN Green Building Labeling Non-Resource Accomplishments for 2013-14 from Annual Report and ODC Study	Verified Accomplishments for 2013-2014	Verified Accomplishments for Q1 and Q2 2015
According to the Annual Report, the Green Building Labeling program held two Home Appraiser trainings resulting in the certification of 23 appraisers. Training will continue in 2015.	SoCalREN provided data ¹ to show that there were a total of 44 individuals who attended two Home Appraiser trainings in 2014 (no trainings were held in 2013). There is no indication which of these 44 attendees became certified, as it requires passing an examination.	Data from SoCalREN shows that 55 individuals attended Home Appraiser trainings held in 2015. There is no indication which trainees were certified.
ODC's draft report states that 516 realtors were certified through Certified Green Real Estate Professional and National Association of Realtors (NAR) Green Designation trainings. The Annual Report supports this claim as it notes that a total of 11 NAR trainings were carried out resulting in the certification of 500 realtors during the 2013-2014 program years.	Data provided by SoCalREN ¹ shows that 1,537 trainees attended Certified Green Real Estate Professional and National Association of Realtors trainings in 2013-2014.	The SoCalREN data ¹ also show 338 individuals attended NAR trainings in 2015 through end of May 2015.

1 An Excel file entitled, "SoCalREN Green Real Estate.xlsx" lists attendees of Home Appraiser trainings held by SoCalREN and indicates dates during which the trainings were attended from 2014 through Q2 of 2015. The file also includes a database of individuals who attended Certified Green Real Estate Professional and National Association of Realtors (NAR) Green Designation trainings from 2013 through May of 2015.

Low Income Single Family

The Low Income Single Family program is designed to connect participants of the Community Development Commission of the County of Los Angeles to Home Upgrade programs, particularly those who fall in the lower income brackets. Non-resource accomplishments related to the Low Income Single Family service area are taken from SoCalREN's Annual Report and are presented in Table 7-17. SoCalREN provided clarifications for the first two

accomplishments in the table since they were not accurate as initially written and included in the Annual Report. These clarifications are included in column 2 of the table below.

Table 7-17: SoCalREN Single Family Low Income Accomplishments from 2015 Annual Report

SoCalREN SF Low Income Non-Resource Accomplishments for 2013-14 from Annual Report and ODC Study	Verified Accomplishments for 2013-2014	Verified Accomplishments for Q1 and Q2 2015
<p>SoCalREN noted in their Annual Report that it provided 25 contractors incentives to complete a Building Performance Institute (BPI) Building Analyst certification at five marketing workshops held in Southern California in conjunction with the Community Development Block Grant Community meetings held in the fall of 2014. Five contractors were reimbursed for the cost of BPI Certification and completed the training.</p>	<p>In its response to the contractor team’s data request SoCalREN noted that contractors were offered a limited time opportunity to receive an incentive for BPI training and only five completed the requirements for reimbursement. Additionally, BPI trainings were coordinated individually by contractors. They were not offered at “five marketing workshops”; rather, contractors were initially notified about this opportunity at said workshops. Data provided by SoCalREN¹ show a list of 28 contractor companies who were informed of the BPI trainings.</p>	<p>The SoCalREN data show¹ that one contractor company completed the requirements for reimbursement for completion of the BPI Building Analyst certification in 2015.</p>
<p>SoCalREN also sent several thousand flyers to low-income residents to encourage upgrades in low-income homes. A total of 226 applications were sent along with flyers to eligible applicants for each District.</p>	<p>SoCalREN clarified this achievement in its response to the data request sent. It noted that 226 was the number of active applications at the time of Annual Reporting. Applications that were active in December 2014 have since been cancelled.</p>	<p>No accomplishment provided.</p>
<p>The original non-resource accomplishment taken from the Annual Report stated the following: SoCalREN also sent several thousand flyers to low-income residents to encourage upgrades in low-income homes. A total of 226 applications were sent along with flyers to eligible applicants for each District.</p>	<p>SoCalREN provided a revision to their non-resource accomplishment and stated the following: Counting inactive applicants, a total of 451 homeowners were educated on Home Upgrade in 2014 through the Low Income program. Every application is sent Home Upgrade program information as well as referred to IOU low income programs such as Energy Savings Assistance Program and California Alternate Rates for Energy. Contact information is only available for those who submitted an application. The database provided by SoCalREN shows that of the customers who submitted program applications, 452 had project start dates in 2014 (this does not verify that these applicants have been educated about the Home Upgrade program). Of these, 72 have active projects.</p>	<p>A total of 453 applicants have project start dates in 2015 and of these, 195 have active projects. The data for 2015 goes through Q2. Again, the data provided do not clarify whether these applicants have been educated about the Home Upgrade program.</p>

1 An Excel file entitled, “SoCalREN Low Income.xlsx” provides a list of contractor companies that were informed of BPI trainings and those who completed the requirements for BPI certification. The data also include names and contact information of low income program applicants and project start dates and status.

Financing

Financing initiatives provided by SoCalREN include the following during the 2013-14 program years:

- Residential Loan Loss Reserve, and
- Nonresidential Property Assessed Clean Energy (PACE) Financing.

No verification of non-resource accomplishments, merging of datasets to CPUC tracking data, or evaluability of non-resource program data is being conducted for these financing options. Appendix B provides selected non-resource accomplishments of SoCalREN's financing initiatives as presented in its Annual Report and provided directly to the evaluation team in response to the data request that was submitted in support of this impact assessment.

Southern California Regional Energy Network Public Agency Program (SoCalREC)

Services are offered to local government and other public agencies through SoCalREC so that they may be able to more cost effectively make energy efficiency upgrades and improve their energy management practices. The areas in which SoCalREC offers services are as follows:

- Aggregated Regional Procurement & Integrated Comprehensive Whole Building Retrofits (Project Delivery);
- Climate Action Plan/Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC);
- Water Energy Nexus;
- Regional Energy Project Tracking and Permitting System (CEEPMS);
- Marketing, Outreach, Education, and Training; and
- Workforce Development.

Databases were requested by SoCalREN to aid in the verification of selected non-resource accomplishments achieved by the Southern California Regional Energy Network Public Agency Program (SoCalREC). Most of these accomplishments were taken from ODC's Value and Effectiveness Study and sent to SoCalREN so they could provide the evaluation team with the appropriate datasets for the verification activity. In response, SoCalREN provided a plethora of information and datasets and after review of the materials, the evaluation team was able to use some of them to verify a subset of the non-resource accomplishments. Below is a presentation of selected non-resource accomplishments for the services offered through SoCalREC and results of the verification analysis, when data were available from SoCalREN.

Aggregated Regional Procurement & Integrated Comprehensive Whole Building Retrofits (Project Delivery)

As described in SoCalREN’s 2015 Annual Report, the Project Delivery service offered by SoCalREC supports public agencies in their strategies to carry out integrated demand side management of energy use. Table 7-18 presents the non-resource accomplishments related to project delivery and the data provided by SoCalREN, was able to closely verify one accomplishment (row 2) and report a higher quantity for the other two (rows 1 and 3). No additional accomplishments were provided for 2015 through Q2 for the Project Delivery service area.

Table 7-18: SoCalREN Project Delivery Service Non-Resource Accomplishment from ODC’s Value and Effectiveness Study

SoCalREN Project Delivery Non-Resource Accomplishments for 2013-14 from ODC’s Study	Verified Accomplishments for 2013-2014	Verified Accomplishments for Q1 and Q2 2015
Five completed projects	Data provided by SoCalREN ¹ verifies five completed projects	Data provided by SoCalREN ² shows a list of 10 project records carried out in 2015 through Q2.
Fifty-six public agencies that have adopted the Enterprise Energy Management Information System (EEMIS)	SoCalREN provided a summary file ¹ showing 54 agencies included and using EEMIS	No additional accomplishment provided
Approximately 150 facilities monitored by EEMIS	Data were provided by SoCalREN ² to show a list of facilities and locations that are monitored by EEMIS. There is no flag to indicate which line items are facilities; however based on the summary file, it appears that 253 facilities and locations are monitored.	No additional accomplishment provided

- 1 SoCalREN provided ODC an Excel file entitled, “Public Agency Data.xlsx” that lists in progress and completed projects completed or being completed by public agencies through SoCalREN.
- 2 SoCalREN provided an Excel file entitled, “Tracking Database Excerpts.xlsx” that provided a list of projects carried out in 2015.
- 3 SoCalREN provided an Excel file entitled, “EEMIS Summary.xlsx” that provided a list of public agencies that have adopted the EEMIS.

Climate Action Plan/Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC)

The Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC) coordinates regional climate action and sustainability strategies. SoCalREN is using the LARC and program funds to develop a countywide climate action and sustainability plan. To support this effort, SoCalREN, contracting with UCLA, has developed an Interactive Energy Atlas, which displays energy consumption and similar data on the neighborhood, city, or other regional

level.⁷⁰ As stated in ODC’s report, LARC held 2 Energy Atlas workshops in 2014. Attendance lists and supporting documents for these workshops were provided by SoCalREN in response to the evaluation team’s data request. An additional workshop was held in 2015 and an attendance list for this workshop was also provided (see Table 7-19).

Table 7-19: SoCalREN Climate Action Plan/LARC Non-Resource Accomplishment from ODC’s Value and Effectiveness Study

SoCalREN Climate Action Plan/LARC Non-Resource Accomplishments for 2013-14 from ODC’s Study	Verified Accomplishments for 2013-2014	Verified Accomplishments for Q1 and Q2 2015
Delivery of two Energy Atlas workshops	SoCalREN provided attendance records ¹ to verify that two Energy Atlas workshops were held in 2014.	Data from SoCalREN ¹ verifies that one additional Energy Atlas workshop was held in

1 Attendance rosters Energy Atlas workshops held in June and September 2014 were provided by SoCalREN. An attendance list was also provided for a workshop held in July 2015.

Water Energy Nexus

The goal of the Water Energy Nexus pilot was to increase awareness about the interconnectedness of water and energy, and educate the public about how saving water can also lead to energy savings. The non-resource accomplishment below in Table 7-20 was taken from ODC’s Value and Effectiveness Study and was verified by the evaluation team using reports provided in response to the data request submitted in support of this evaluation. While the evaluation team could verify the 2013-14 non-resource accomplishment associated with the Water Energy Nexus pilot, no additional accomplishments for this pilot project were provided. According to ODC’s study, this program was halted due to lack of interest from the IOUs and water agencies.

⁷⁰ Description of Climate Action Plan/Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC) is taken from ODC’s Value and Effectiveness Study, p. 41.

Table 7-20: SoCalREN Water Energy Nexus Non-Resource Accomplishment from ODC’s Value and Effectiveness Study

SoCalREN Water Energy Nexus Non-Resource Accomplishments for 2013-14 from ODC’s Study	Verified Accomplishments for 2013-2014	Verified Accomplishments for Q1 and Q2 2015
Provided 10 facility-wide energy and water audits to public agencies	SoCalREN provided audit reports ¹ for 10 schools in two school districts to verify this accomplishment.	No accomplishment provided.

¹ Audit reports for 10 schools were provided by SoCalREN in response to the data request submitted by the evaluation team in support of this assessment. The reports are entitled, “Water Audit Report Provided for Conejo Valley Unified School District,” May 2015 and “Water Audit Report Provided for Ventura Unified School District,” April 2015. Both were provided by SoCalREN through its auditor CLEAResult.

Regional Energy Project Tracking and Permitting System (CEEPMS)

The evaluation team did not request databases to verify the Regional Energy Project Tracking and Permitting System (CEEPMS) non-resource accomplishments listed in the SoCalREN 2015 Annual Report or in ODC’s Value and Effectiveness Study. Because the non-resource accomplishments for this service area of SoCalREC have not been verified, a listing of selected accomplishments is presented below (the non-resource accomplishments listed below in italicized text are taken directly from SoCalREN’s Annual Report).

- *Completed the CEEPMS prototype for the cities of Santa Monica and Brea.*
- *Produced documentation of lessons learned, training methods for replication and expansion into other jurisdictions, based on the Santa Monica and Brea benchmark prototype.*
- *Demonstrated functionality tests of the original Santa Monica CEEPMS software to serve as a benchmark for the permit-to-rebate matching logic, as well as for database imports of programs and individual incentives.*
- *Created a Product Development Plan for enhanced CEEPMS 2.0 which overcomes technical issues identified in CEEPMS prototype 1.0, and design improvement features.*

Marketing, Outreach, Education, and Training

The evaluation team did not request databases to verify the Marketing, Outreach, Education, and Training non-resource accomplishments listed in the SoCalREN 2015 Annual Report or in ODC’s Value and Effectiveness Study. Because the non-resource accomplishments for this service area of SoCalREC have not been verified, a listing of selected accomplishments is presented below (the non-resource accomplishments listed below in italicized text are taken directly from SoCalREN’s Annual Report).

- *Prepared, coordinated and implemented a comprehensive communications plan to promote the SoCalREN.*
- *Established and launched website for the SoCalREN and its subprograms.*
- *Set up toll-free number and e-mail inquiry system to respond to program interest from public agencies and general public.*
- *Coordinated with IOU marketing departments on co-branded materials.*
- *Provided information to local governments and other public agencies (e.g., e-mail announcements, flyers, participation at expos, trade shows, etc.) to lead interested parties to website.*
- *Created monthly e-newsletter and distributed regular e-blasts related to the SoCalREN and its subprograms promoting activities and resources while driving traffic back to the website.*
- *Created and distributed SoCalREN Technical Report including metrics collected across all subprograms.*
- *Attended conferences and events to promote the SoCalREC program and engage potential agencies.*
- *Designed and held workshops for local government and public agency facilities managers highlighting best practices while educating local governments about success stories in which energy and budget savings resulted from EE retrofits.*
- *Held joint SCE/SoCalGas/SoCalREC program information sessions for participating jurisdictions.*
- *Educated agencies on the SoCalREC Turnkey Project Delivery model.*

Workforce Development

The evaluation team requested information to verify the non-resource accomplishments related to the SoCalREC Workforce Development service area. Information to support some of the accomplishments listed below was provided by SoCalREN (an * next to the accomplishments below indicates the cases where the accomplishment could be verified based on the information sent). The non-resource accomplishments provided by ODC in its Value and Effectiveness Study and listed in SoCalREN's Annual Report are reproduced here (the non-resource accomplishments listed below in italicized text are taken directly from SoCalREN's Annual Report).

- *Identify need/demand for labor in nonresidential building sectors such as Municipal, University, School, and Hospital (MUSH)*
- *Determine the jobs and investment required to achieve Zero Net Energy in MUSH sector*

- *Connect training and pre-apprenticeship resources with potential labor pools*
- *Establish link to existing registered apprenticeship programs*
- *Expand the competitive capacity of diverse companies to compete for and perform energy efficiency projects in the MUSH sector*
- E-Contractor Academy created*
- 110 small, minority, and disabled, contractors who have graduated from E-Contractor Academy*
- 7 graduates who have become pre-qualified to perform work for L.A. County*
- 3 LA County contracts awarded to graduates*
- 2 graduates assisted with prequalification for LA Unified School District projects*

7.2.2 Evaluability of Databases

SoCalREN provided numerous Excel files that contain the data used to verify the non-resource accomplishments presented in the above subsection. Of these files, a total of 4 were assessed for quality, completeness, and consistency of:

- Contact information (names, addresses, and phone numbers),
- Merging variables (account numbers and customer IDs), and
- Details about recommendations, referrals, and/or attendance at workshops or events.

A subset of the total number of databases provided was selected because not all of the files would be useful in an evaluation of impacts that stem from non-resource activities. The four files that were evaluated are as follows with descriptions of their contents:

- *SoCalREN Multifamily.xlsx, Tab name: Q3 Assessment Incentives*, a database of 24 multifamily customers who have had an energy assessment and received an assessment incentive from SoCalREN.
 - The data fields included in this table are: primary project contact, full name, phone, e-mail, name of building ownership entity, electric utility service account number, gas utility service account number, project name, number of units, address, audit date (Date AHSRAE Level II audit performed by Participating Rater), description of audit, assessment incentive recipient (applicant or rater), and incentive paid date.
 - The database contains electric and gas service account IDs, therefore merges of data to CIS, billing, and CPUC tracking data can be carried out.

- Fields are very well populated with no missing data in any of the fields. The descriptions of audits field describes in detail the recommendations provided to the customer from the audit.
- Overall, the key variables necessary for contacting customers in the future and merging to CIS and IOU tracking data are being collected and are well populated. Furthermore, information on recommendations that may be developed as part of the assessments are also being tracked.
- *SoCalREN Low Income.xlsx, Tab name: Q2 Low Income Projects*, a database containing 903 applicants for Home Improvement Program (low income) projects in 2014-2015.
 - Fields of data include: applicant (name), project start date, address, flag to indicate if the project is active, Home Upgrade project name (scarcely populated), and a flag to indicate whether or not the applicant was referred to a utility low income program.
 - Of the applicants 452 had project start dates in 2014. Of these, 72 have active projects. The remaining 453 have project start dates in 2015 and of these, 195 have active projects.
 - There are no customer account IDs or service account IDs, thus making this database difficult to use for merging with CIS, billing, or CPUC tracking data.
 - Almost all fields are completely filled out and use consistent format. The only field that is scarcely populated is the Home Upgrade project name field.
 - Overall, many of the key variables necessary for contacting customers in the future are not being collected, such a phone numbers, e-mails and sometimes names. Service account numbers are not being collected that would allow for a direct merge to CIS and IOU tracking data. Finally, no information is provided on the details of any actions that might have been recommended to or taken by the customer.
- *SoCalREN_Local Marketing and Outreach.xlsx, Tab name: Q1 Contractor Listing*, a database maintained by SoCalREN of trained contractors with 107 records (79 contractors entered in 2013-14 and 28 entered in 2015 through July).
 - Salient fields included in this table are as follows: account (contractor company) name, license number, program name, shipping address, contact name, e-mail, phone, website, a 0/1 flag to indicate whether QC mentoring has been completed or contractor has been granted exempt status, contractor status (active & registered; active & not registered; inactive and registered; inactive & not registered; contractor lead; dead lead; awaiting enrollment paperwork), TEN-Only PC (a 0/1 flag to denote that the participating contractor is active and registered with The Energy Network only), a 0/1 flag to indicate contractor paperwork agreement submitted, expiration dates of various liabilities, and date record was created.
 - Fields are extremely well populated. For the 79 contractors who were entered into the database, there are no missing records for the variables listed above.

- The ability to merge this database to CIS, billing data, or CPUC tracking data is not applicable as these data could be used to implement a trade ally survey and not necessarily would it be used to directly verify energy efficiency savings from resource programs.
- Overall, the key variables necessary for contacting contractors in the future are being collected and are well populated.
- *SoCalREN_Local Marketing and Outreach.xlsx, Tab name: Q4 Resident Calls*, a database showing 476 residents who were assisted by phone through SoCalREN.
 - The fields of data available for these residents are as follows: date/time of call, caller's first name, caller's last name, phone, e-mail, electric service provider, gas service provider, county, caller type (the call center identifies the caller type - Resident, Contractor/Auditor/Supplier, Government Official, Commercial Property Owner, Financial Institution, Utility, Public Agency, Trade Union, Other), and call category (the call center identifies the call category - 1099, Application/Rebate Status, Co-op Marketing, Complaint, Cool Comfort Financing, Follow-up to Previous Call, General Inquiry about Home Upgrade or Multifamily Whole Building Upgrade, Home Energy Loans, Home Upgrade, How to Become a Participating Contractor, IOU Rebates/Incentives, LA County PACE, Multifamily, Solar, Upgrade Coupons, Workshops/Events/Educational Opportunities, Other).
 - The database contains 228 individual records from 2/11/2014 through 6/29/2015. A single line item represents the 318 callers who were assisted before 2/11/2014 as detailed records for each of these calls were not recorded before this date. Based on the data provided, a total 476 residents were assisted. Tracking of individual calls began after 2/11/2014. Prior to this, a total number of calls was listed for the period between 2013 and 2/11/2014.
 - There are no customer account IDs or service account IDs, which would make it difficult to merge this dataset to CIS, billing, or CPUC tracking data.
 - The database is moderately well populated. For the records covering calls that were logged in 2014 (beginning on 2/11), there are 39 missing phone numbers, 25 missing first names, 49 missing last names, 128 missing e-mails, 49 missing electric providers, and 50 missing gas providers. Each record does contain detailed notes about the purpose of the call and this information could be used to conduct further inquiry about the usefulness of the information provided on the call in their decisions to participate in energy efficiency or other related programs.
 - Overall, the key variables necessary for contacting customers in the future are being collected and are moderately well populated. Service account numbers are not being collected that would allow for a direct merge to CIS and IOU tracking data. Furthermore, detailed notes about the purpose of the call are being gathered.

Overall, the databases provided by SoCalREN are in moderate to good shape. SoCalREN did provide databases that were relatively well populated, which would allow customers and contractors to be contacted. Additionally, the data contained in the tables were consistent. However, for some key databases some improvements could be made with respect to gathering contact information. Most of the reviewed datasets do not provide variables that would be useful for merging to other datasets for impact evaluation purposes. One positive attribute of these datasets is that details of assessments and resident calls were recorded. This is useful for evaluation work, as the data could be used to follow up with customers to determine if their interactions with SoCalREN led them to participate in energy efficiency resource programs.

7.2.3 Results of CPUC Tracking Data Merges

Attempts to merge four different datasets to CPUC tracking data were made with varying degrees of success. The selection of SoCalREN databases was made based on the activity it tracked and the suitability of the data's ability to merge. The first dataset selected includes 24 records of customers who received incentives for conducting an assessment through SoCalREN's Multifamily program area. The second is a SoCalREN's database of 428 customers who participated in SoCalREN's Home Upgrade program. Note that this dataset does not represent a non-resource activity, but a merge of data was attempted to see how well the CPUC tracking data could be matched to records kept by SoCalREN. The third and fourth datasets are smaller. The third is a database of 228 residents that were assisted through the Home Upgrade Advisor hotline during 2013-2014. The last dataset includes a list of 4 recipients of Advanced Home Energy Upgrade Coupons.

Merging SoCalREN Multifamily Assessment Records

The customer information for recipients of assessment incentives conducted through SoCalREN's Multifamily program came from an Excel workbook provided by SoCalREN called "SoCalREN Multifamily.xlsx". The workbook listed project name, customer name, building owner's name, electricity and gas service account ID, customer phone number, service address, city and zip code, contact e-mail address. There are 24 observations in the dataset, uniquely identified by project name.

The dataset was merged to the tracking dataset by (1) electricity and gas service account ID, (2) addresses, (3) names, (4) phone numbers, and (5) e-mail addresses. The number of unique project names remaining after each merge step are listed in Table 7-21 below. After each step, the merged records were manually checked to make sure that the site listed in SoCalREN's records is the same site as the one merged from the tracking data.

Table 7-21: Merging Steps of SoCalREN Multifamily Program Database to Tracking Data

Merging Steps	# Obs Left	# Project Names Left	% Left
RawData	24	24	100%
After Account Merge	14	14	58%
After Address Merge	14	14	58%
After Name Merge	14	14	58%
After Phone Merge	14	14	58%
After E-Mail Merge	14	14	58%

1. Merge by Service Account ID: SoCalREN MF Assessment program records were merged to the tracking data by service account ID. SoCalREN's dataset provided electric service account ID and gas service account IDs. The information was used first to merge to the tracking data. Overall, 10 records were merged in this step.
2. Merge by Address: SoCalREN MF program records were merged to the tracking data by address. The merge was considered valid if the two fields had the same city/zip and name information. The names from SoCalREN MF Assessment data and the CPUC tracking data were manually checked to match the names that were differently spelled. No additional records were merged in this step.
3. Merge by Name: SoCalREN MF Assessment program records were merged to the tracking data by name. The merges were then checked manually to determine if the addresses matched. No additional projects merged in this step.
4. Merge by Phone Number: SoCalREN MF Assessment program records were merged to the tracking data by phone number. Again the merge were checked manually to determine if the addresses were matched. No extra observations were merged in this step; all were covered in the earlier steps.

Based on the results of this merge, less than half of the customers who received assessment incentives through the multifamily program could be tracked back to the CPUC tracking data (a total of 10 out of 24). This provides moderate support that some customers do go on to participate in resource programs offered by the California PAs.

A summary of the number of SoCalREN Multifamily project names and unique sites that merged with resource program claims in CPUC tracking data can be seen in Table 7-22. These tables break down the project names and unique sites that merged back up to SoCalREN claims and the number that merged up to SCE and SCG resource claims as a way to determine if participation in SoCalREN's multifamily program (albeit a resource program) has led these customers towards resource activities offered by IOUs. The number of project names that merged with SoCalREN claims is nine and is only five for SCE and 1 for SCG. What is more interesting is that while a

total of nine sites merged back up to SoCalREN claims, a total of 30 unique sites merged to SCE and SCG. This shows support for the effect of this program activity on generating energy savings through other CA PA energy efficiency programs.

Note that the number of merged project names in Table 7-22 exceeds the number of project names that merged above. This could be because a single customer may be involved in multiple SoCalREN, SCE, and/or SCG claims.

Table 7-22: Number of SoCalREN Multifamily Program Observations and Sites Merged to Tracking Data

PA	# of Project Names Merged	# of Sites Merged
SoCalREN	9	9
SCE	5	17
SCG	1	13
Total	15	39

Merging SoCalREN Home Upgrade Assistance Project Records

The information for the customers who participated in SoCalREN Home Upgrade Advisor program came from an Excel workbook provided by SoCalREN called “SoCalREN Home Upgrade.xlsx”. As stated earlier, this database tracks participants of a resource program offered by SoCalREN and therefore a reasonably successful merging of this dataset to the CPUC tracking data was expected. The purpose of the other merges to CPUC tracking data was to see if customers who engage in non-resource program activities conducted by the RENs and CCA were found in the CPUC tracking data as participants of resource programs.

The workbook listed:

- 1) Project name,
- 2) Applicant information, including application code, applicant name, application date,
- 3) Utility account IDs, including electricity service account number (from SCE), SCG account name, and gas service account number (from SCG),
- 4) Home owner information, including address, city, zip, e-mail and phone number,
- 5) Project contact information, including project contact name, project owner name, project address, city, zip, and project ID, and
- 6) Recipient information, including recipient name, address, city, and zip.

The dataset was uniquely indexed by Project ID and contained 428 records.

The dataset was merged to the tracking dataset by (1) application code, (2) service account number, (3) addresses, (4) names, (5) phone numbers, and (6) e-mail addresses. The number of unique IDs left after each step of merging is listed in Table 7-23 below. After each step, the merged records were manually checked to make sure that the site listed in SoCalREN’s records is the same site as the one merged from the tracking data.

Table 7-23: Merging Steps of SoCalREN Home Upgrade Advisor Database to Tracking Data

Merging Steps	# Obs Left	# Project IDs Left	% Left
RawData	428	428	100%
After Application Code Merge	179	179	42%
After Acct Merge	149	149	35%
After Address Merge	149	149	35%
After Name Merge	148	148	35%
After Phone Merge	148	148	35%
After E-Mail Merge	148	148	35%

1. Merge by Application Code: SoCalREN Home Upgrade Advisor program data records were merged to the tracking data by application code first. A total of 249 unique project IDs were merged.
2. Merge by Account ID: The SoCalREN Home Upgrade Advisor program data records were merged to the tracking data by service account ID. The HUA dataset provided both electricity account ID (SCE) and gas account ID (SCG). Therefore, SoCalREN records were merged to the tracking data relying on both account IDs. Overall, 30 unique project ID were merged in this step.
3. Merge by Address: The SoCalREN program data records were merged to the tracking data by address. The SoCalREN data provided three sets of addresses: home owner address, project address, and recipient address. Both home address and project address were used. The merge was considered valid if the fields had the same city and name information. The names from the HUA records and the CPUC tracking data were manually checked to match the names that were differently spelled.
4. Merge by Name: The SoCalREN program data records were merged to the tracking data by name. The SoCalREN data provided five sets of name variables: 1) applicant name, 2) project contact name, 3) project owner name, 4) recipient name and 5) SCG account name. The records merged to the tracking data if any of the variables matched the name variables in the tracking data. The merges were then checked manually to determine if the addresses matched. If so, the merge was considered valid. Overall, one unique project ID was merged in this step.

5. Merge by Phone Number: The SoCalREN Home Upgrade Advisor program data records were merged to the tracking data by phone number. Again the merges were checked manually to determine if the addresses were matched. No more unique project ID were merged in this step.
6. Merge by E-Mail Address: The SoCalREN Home Upgrade Advisor program data records were merged to the tracking data by e-mail address. Again the merge were checked manually to determine if the addresses were matched. No more unique project ID were merged in this step.

The SoCalREN Home Upgrade Advisor data is the most comprehensive and consistent of all the reviewed datasets. Approximately 65% of the records (a total of 280 project IDs) in this database could be merged to the CPUC tracking data. This is expected as the energy savings from these projects are claimed by SoCalREN in its portfolio of energy efficiency programs. It is interesting to note that all of the projects are not found in the tracking data, however this could be because not all of the projects that were recently completed have been included in the CPUC tracking data yet.

A summary of the number of SoCalREN Home Upgrade Advisor project IDs and unique sites that merged with resource program claims in CPUC tracking data can be seen in Table 7-24. These tables break down the project IDs and unique sites that merged back up to SoCalREN claims and the number that merged up to SCE and SCG resource claims as a way to determine if participation in SoCalREN's Home Upgrade Advisor program has led these customers towards resource activities offered by IOUs. The number of IDs that merged with SoCalREN claims is 249, is 71 for SCE, and is 73 for SCG. This shows some support for the effect of this non-resource activity on generating energy savings through CA PA energy efficiency programs. Not surprisingly, a majority of the IDs and sites that merged up to the tracking data were merged to SoCalREN claims.

Again it is important to remember that the number of merged project IDs in Table 7-24 exceeds the number of merged Project IDs resulting from the merges presented in Table 7-23 because a single customer may be involved in multiple SoCalREN, SCE, and/or SCG claims.

Table 7-24: Number of SoCalREN Home Upgrade Advisor Database Observations and Sites Merged to Tracking Data

PA	# of Project IDs	# of Sites
SoCalREN	249	249
SCE	71	70
SCG	73	84
Total	394	403

Merging SoCalREN Home Upgrade Residential Hotline Records

The customer information for the SoCalREN Home Upgrade residential phone call records came from an Excel workbook called “SoCalREN_Local Marketing and Outreach.xlsx”. The workbook listed customer name and phone number, and in one case, e-mail, too. Therefore, the file was merged to the tracking data if both the phone number and name matched.

Overall, there were 198 observations, and 190 unique sites (different names and/or phone number). Only two observations and two sites were merged to the tracking data, and the other 99% did not find a match. There was too limited information. Many observations did not have name or phone number, and there were 30 observations that had no information at all. Records of those who call for assistance could be improved in order to track this non-resource activity.

Merging SoCalREN Home Upgrade Residential Coupon Records

The customer information for SoCalREN Home Upgrade residential phone call records came from an Excel workbook called “SoCalREN_Local Marketing and Outreach.xlsx”. The workbook listed customers’ name, addresses, phone number and e-mail addresses. The file only had four observations and hence was merged to the tracking data manually.

Three out of four unique customers found matches in the tracking data. The only one that had no match had the coupon issued date being May 22, 2015, and probably had not been entered into the tracking data yet. SoCalREN had noted in its Annual Report and in response to this data request that a larger number of Advanced Home Upgrade Coupons had been issued but not tracked. Had the issuance of these coupons been recorded, additional records would be available to attempt to merge to the CPUC tracking data and help determine if customers who receive these coupons are using them to participate in PG&E’s Advanced Home Upgrade program.

7.3 MCE

The following four programs were offered by MCE during the 2013-14 program years:

- Multifamily,
- Small Commercial,
- Single Family, and
- Financing.

A verification of non-resource accomplishments is presented below for the Multifamily, Small Commercial, and Single Family programs.⁷¹ Next, an evaluability assessment of the databases provided by MCE is conducted in which the completeness, quality, and applicability of the data is reviewed. A subset of the 27 files of mixed format (i.e., MS Word, MS Excel, .pdf, and .msg) were examined and assessed. Lastly, merges to CPUC tracking data were carried out using two different non-resource datasets to see if customers who interacted with MCE went on to participate in any California PA energy efficiency resource programs. The first dataset contains customers who received audits and participated in MCE's Small Commercial program and the second contains the multifamily properties that received Technical Assistance direct install measures.

7.3.1 Verification of Non-Resource Accomplishments

This section presents the verification of selected non-resource accomplishments of MCE's programs as presented in:

- MCE's 2014 Energy Efficiency Annual Report; and
- MCE's response to the data request submitted by the evaluation team that was used to acquire data to support this impact assessment.

The ODC Regional Energy Networks Value and Effectiveness Study did not cover MCE and therefore no non-resource accomplishments for MCE were available from this data source.

Multifamily Program

Results of the verification of non-resource accomplishments for the Multifamily program are presented in Table 7-25. Using CPUC tracking data or databases provided by MCE, the evaluation team was able to verify some of the Multifamily program non-resource

⁷¹ The non-resource accomplishments of the Financing program taken from MCE's 2014 Energy Efficiency Annual Report are presented in Appendix B and have not been verified.

accomplishments. In most cases, MCE reached a greater number of customers through technical assistance (row 3), provided rebates for a larger number of multifamily units (row 4), and saved more gallons of water than it had noted in its Annual Report (row 5). For example, MCE claimed to have provided technical assistance to 2,304 units. Based on the database MCE provided, the evaluation team verified that 3,122 units received technical assistance in 2013-14. Additionally, MCE claimed to have trained 12 workforce entrants or re-entrants and it was able to verify that 12 were trained in 2014 with an additional 9 attendees at DI training in 2013 (row 5).

Only one 2015 Multifamily program non-resource accomplishment was shared by MCE in its response to the data request submitted in support of this assessment. MCE has continued to provide technical assistance in the first 2 quarters of 2015 by providing an additional 1,152 units with assistance, as shown in the last column of Table 7-25. This was verified in a database provided by MCE.

Table 7-25: Selected MCE Multifamily Non-Resource Accomplishments Presented in 2014 Annual Report

MCE Multifamily Non-Resource Accomplishments for 2013-14 from Annual Report	Verified Accomplishments for 2013-14	Verified Accomplishments for Q1 and Q2 2015
Held a workshop in Richmond with BayREN which resulted in three applications out of 10 attendees	Verified a total of six attendees and was not able to verify how many attendees completed applications ¹	Accomplishment not provided
Communicated program success stories through published case studies and testimonial from program participants at workshops	MCE provided a .pdf file of a case study project of 70 multifamily units that were upgraded with three boiler replacements, pipe insulation and DI measures. MCE did not provide any distribution lists to indicate who has seen the file.	Additional data for 2015 not provided
Reached 2,304 units with Technical Assistance	Data from MCE ² show 3,122 units received TA in 2013/14 (1,401 in 2013 and 1,721 in 2013)	Data from MCE ³ show 1,152 units received TA in Q1/Q2 of 2015.
There were 555 units touched by energy efficiency projects	CPUC tracking data shows 1,849 claim IDs and 562 MCE SiteIDs	Not verified
Successful relationship with local water agencies saved more than 882,242 gallons of water	Data from MCE ⁴ show 1,082,816 gallons of water saved from DI measure installations	Accomplishment not provided
Trained 12 workforce entrants or re-entrants in direct install	Data from MCE ⁵ show 12 workforce attendees to DI training in 2014 and nine who attended DI training in 2013.	Accomplishment not provided

- 1 MCE provided a .pdf file entitled, “MCE01_01_Richmond MF workshop sign in.pdf” which included a list of 6 attendees of the Multifamily workshop held in Richmond.
- 2 MCE provided a dataset called “MCE01_05_MF Pipeline Database 06032015.xlsx” and a revised version called “MCE01_05_MF Pipeline Database Revised 9 14.xlsx”. The dataset lists more multifamily units than are included in the totals provided TA in 2013-2015 and the dataset does not clarify why certain units are excluded

from the total. A follow up discussion was held with MCE to clarify why certain properties were excluded from the total.

- 3 In the dataset, “MCE01_05_MF Pipeline Database Revised 9 14.xlsx”, a list of properties that are in the pipeline for 2015 are included as well.
- 4 MCE provided an Excel file called “MCE Direct Install Tool_Pullman.xlsm” which is a tool that calculates water savings from installed low flow showerheads and faucet aerators. A discussion with MCE clarified that the actual water savings estimate differed from what was presented in the 2014 Annual Report.
- 5 MCE provided a list of individuals who attended DI training and weatherization training in 2013 and 2014. The data file is called “MCE01_04_8-17-15 - Updated MCE DI TrainingList (MCCDC).xlsx”

Additional non-resource accomplishments were provided by MCE for its Multifamily program and these are listed in Table 7-26 and Table 7-27. Attempts to verify these accomplishments were made when supporting data were provided or made available by MCE in response to the data request submitted by the contractor team. Again, in most cases MCE’s documentation did verify its additional non-resource accomplishments or show that they exceeded their stated accomplishments. As Table 7-26 shows, MCE verified the installation of DI measures in 726 units (row 1), the provision of technical assistance to 1,721 units (row 2), and the installation of energy efficiency upgrades at seven properties which affected 506 units in 2013 (row 3).

Table 7-26: MCE Multifamily Non-Resource Accomplishments Provided by MCE for 2013

MCE Multifamily Non-Resource Accomplishments Provided by MCE	Verification of Accomplishments
Installed CFLs, low-flow showerheads and faucet aerators, and pipe wrapping (in 220 units) in 726 units at no additional cost to tenants	Data from MCE ¹ show 220 units received pipe wrapping and 726 units received low-flow showerheads and faucet aerators.
Provided TA to 1,401 units in 2013	Verified 1,721 units (also presented above in Table 7-25)
There were 506 units across five affordable properties impacted by energy upgrades	Data from MCE ² verifies that 506 units across seven affordable properties were impacted by energy upgrades
Trained 15 workforce entrants or re-entrants	A list of 15 workforce entrants or re-entrants were trained in either weatherization or direct install ³

- 1 MCE provided a dataset called “MCE01_05_MF Pipeline Database Revised 9 14.xlsx”. The dataset states that 220 units received pipe wrapping and 726 received free low-flow showerheads and faucet aerators, but the dataset does not list the individual units that received these measures. Only the name of the buildings in which the units reside are listed.
- 2 MCE’s “MCE01_05_MF Pipeline Database Revised 9 14.xlsx” dataset lists 7 properties that contain 506 units receiving energy upgrades through the Multifamily program, however a clear definition of “affordable” properties was not provided by MCE. This definition was requested, but not provided. The data only lists the property names, the number of buildings, and the number of units each contains.
- 3 MCE provided a list of trainees from 2013 – 2014 called “MCE01_04_8-17-15 - Updated MCE DI TrainingList (MCCDC).xlsx”.

As Table 7-27 shows, MCE has provided technical assistance to 1,152 multifamily units (row 2), provided rebates for upgrades for 288 units (row 5), built a pipeline of 456 units that have reserved rebates (row 4), and has saved 3.3 million gallons of water at one multifamily property (row 7) in the 2015 program year through Q2.

Table 7-27: MCE Multifamily Non-Resource Accomplishments Provided by MCE for 2014 – Q2 2015

MCE Multifamily Non-Resource Accomplishments Provided by MCE	Verification of Accomplishments
Presented program offering to 106 attendees at the Multi-Family Affordable Solar Housing (MASH) workshop, which resulted in one project that is 9% of the kwh savings target and 17% of therm savings	MCE provided a list ¹ of 112 e-mail addresses of training that attended the MASH workshop. There are names associated with 55 of the 112 e-mail addresses.
Provided TA to 1,152 units	Data from MCE ² verified that TA was provided to 1,152 multifamily units.
Scheduled 8/26/15 Direct Install training for 10 workers from disadvantaged communities	No supporting data provided.
Built a pipeline of 456 units for which rebate reservation forms were received in 2015 and anticipate receiving reservation forms for another 237 units by the end of 2015	Data from MCE ³ shows that 456 units either have reserved rebates or have to close their rebate reservation. An additional 160 units are likely to complete a project by the end of 2015.
Completed upgrade projects impacting 288 units	Data from MCE ³ verifies that 288 units have received rebates for energy upgrades.
Launched LED Direct Install offering	MCE provided a .pdf ⁴ that presents a description of the addition of changing out LEDs for incandescent bulbs to its Direct Install offering. No data have been provided to show that LEDs have been installed since the offering was launched.
Saved 1 property (199 units) 3,361,235 gallons of water	MCE provided a one-page .pdf ⁵ that describes the project that saved 199 units 3,361,235 gallons of water. A full description of how the water savings were estimated for this property was not provided.

- 1 MCE provided a list of MASH attendees in an Excel file called “MCE01_06_MASH - energy efficiency participants-April30-2015.xlsx”. The list contains 112 e-mail addresses and names for some of the attendees.
- 2 MCE’s “MCE01_05_MF Pipeline Database Revised 9 14.xlsx” dataset lists 1,152 units as receiving technical assistance in 2015. More properties and units are listed than are included in this total. The data do not make clear why certain units are excluded from the total.
- 3 MCE provided a dataset entitled, “MCE01_07_2015 MF Goals.xlsx” that shows MCE’s progress towards meeting its Multifamily program goals. It shows the number of units on which rebates have been paid for participation the program and rebate reservations. It also shows the number of units that have had energy efficiency upgrades and rebates paid out.
- 4 MCE provided this information in a .pdf called “MCE01_08_Direct Install slide.pdf”
- 5 MCE provided this information in a .pdf called “MCE01_09_Pullman 8.10.pdf”

It is important to note that the quality of the databases provided to support many of the above listed non-resource accomplishments was poor and improvements to MCE’s system of tracking

multifamily technical assistance and installation of DI measures could be made. This will be discussed further in the evaluability of databases section.

Small Commercial Program

Table 7-28 lists the small commercial non-resource accomplishments of MCE as presented in its 2014 Annual Report. Also presented is the verification of the accomplishments using data provided by MCE or by using CPUC tracking data. Based on this analysis, some of the accomplishments could be verified. For example, MCE noted that during 2013-14 it completed 56 energy efficiency upgrades through the program. CPUC tracking data was examined and the evaluation team was able to verify a larger number - 143 claim IDs that represent 87 unique Service Account IDs (row 6). MCE noted that its outreach campaign to the San Rafael Chamber of Commercial resulted in 55 energy assessments (row 4). Data provided by MCE allowed a verification of 49 assessments that resulted from the campaign, which comes close to the claimed number of assessments. The other small commercial non-resource accomplishments listed by MCE were supported through databases sent or documentation provided to the evaluation team, but most of these were not quantity based (see rows 3 and 5).

There were some accomplishments that could not be verified. For example, MCE had provided a one-page progress report that indicated that the small commercial program had completed 2,452 free energy audits from 2013 through Q2 of 2015. Upon examination of a supporting dataset, the evaluation team could verify the completion of 1,779 records for 668 unique electric service accounts that received audits and assessments (row 1). A follow up conversation took place with MCE in which they clarified that it erroneously included both audits and site visits in their count of 2,452 energy assessments and that the dataset they provided was an accurate count.

In addition, MCE noted that it provides customers with pre-negotiated contractor discounts on certain measures (row 2). To support this claim, MCE provided a portion of a dataset that tracks participation in its SmartLights small commercial program with an explanation that it has negotiated a lower negotiated price for measure code CLA10 that appears in its tracking data as custom projects with the measure description "LIGHTING RETROFIT/NEW-INT-LINEAR FLUORESCENT-OTHER". However, the evaluation team was unable to verify discounted price. A comparison of measure costs across MCE's data and PG&E's data in the CPUC tracking data was made but no evidence of a lower measure cost could be found. This is not to say that a lower price has not been negotiated, but that MCE did not provide information to allow the evaluation team to verify this accomplishment.

Last, MCE stated that it paid \$111,125 in rebates through the Small Commercial program (row 7). This could not be verified using the CPUC tracking data because there are a number of errors in the data submitted by MCE regarding incentives paid out. MCE has been made aware of these errors by the contracted Data team working on behalf of the CPUC.

Table 7-28: Selected MCE Small Commercial Non-Resource Accomplishments from 2014 Annual Report

MCE Small Commercial Non-Resource Accomplishments for 2013-14 from Annual Report	Verified Accomplishments for 2013-14	Verified Accomplishments for Q1 and Q2 2015
MCE provided a monthly one-page progress document that shows 2,452 free energy audits ¹ were provided from 2013 – May 2015 through the small commercial program.	Data from MCE ² shows 1,779 records for 668 unique electric SAIDs that received audits and assessments (i.e., site visits) through MCE’s Small Commercial program.	Energy assessments have occurred in 2015 through the small commercial program but were not separated out from those that occurred in 2013-14 in the one-page progress document.
Program offers customers pre-negotiated contractor discounts on certain measures, project management assistance and post-project quality assurance.	In its response to the evaluation team’s data request, MCE stated that it has a negotiated price for measure code CLA10 that appears in its tracking data as custom projects with the measure description “LIGHTING RETROFIT/NEW-INT-LINEAR FLUORESCENT-OTHER”. However, evaluation team was unable to verify discounted price.	No additional accomplishment provided.
Customers that participate in the program are also eligible for financing through MCE’s on bill repayment program and the relevant information is presented to them in the assessment report	MCE provided a mock up assessment report ³ as an example of what is provided to customers who participate in the program. MCE also provided a database ⁴ of customers who were considered eligible for financing and 10 are listed in 2014; all were either rejected or cancelled.	MCE’s database of customers considered eligible for financing includes six customers in 2015. Of these, four were rejected and two were listed “in progress” as of July 2015.
Outreach Campaign through the San Rafael Chamber of Commerce that resulted in 55 assessments and 20 completed projects	Data provided by MCE ⁵ verifies 49 assessments that resulted from the San Rafael Chamber of Commerce Outreach Campaign. Of these assessments, there are 11 completed projects. MCE provided a record of the 189 calls made during the outreach campaign and in-person visits.	No additional accomplishment provided
Communicated program success stories through case studies of projects to promote program offerings	In its response to the data request sent to MCE, it stated that case studies have been disseminated using MCE’s website, at presentations at the San Rafael Chamber of Commerce Green Committee, via social media and outreach campaigns with the San Rafael Chamber of Commerce, and via information on the SmartLights website: http://ebenergy.org/commercial-services/smart-lights-program/	No additional accomplishment provided.

Table 7-28 (Cont'd): Selected MCE Small Commercial Non-Resource Accomplishments from 2014 Annual Report

MCE Small Commercial Non-Resource Accomplishments for 2013-14 from Annual Report	Verified Accomplishments for 2013-14	Verified Accomplishments for Q1 and Q2 2015
Completed upgrades at 56 small businesses	CPUC tracking data shows 143 claim IDs that represent 87 unique Service Account IDs claimed for MCE's small commercial program.	Not verified
Paid \$111,125 in rebates	MCE's data in the CPUC tracking data contains errors therefore the amount paid in rebates in 2013-14 is not verifiable.	Not verified

- 1 MCE provided a progress to date document called "Monthly Update One-Pager - June.pdf" which MCE states erroneously counted site visits in the total of assessments provided. The Excel file provided by MCE to verify the 2013-14 accomplishments related to audits (listed in footnote 2 of this table) is correct.
- 2 MCE provided an Excel file called "MCE02_01_EF_Combined marinCleanEnergy_auditConducted_greaterThanJan1-2013.xlsx" that includes data for the energy assessments, audits, and upgrades that occurred through MCE's Small Commercial program beginning in 2013.
- 3 MCE provided the evaluation team with an example report in a .pdf file entitled, "MCE02_03_sample final report.pdf"
- 4 MCE provided an Excel file entitled, "MCE02_04_EF_MCE OBR Candidates Audit Summary.xlsx" that contains 16 businesses that were initially considered eligible for financing, however all but 3 customers were rejected. One of the projects was cancelled and the other two have "in progress" as their status.
- 5 MCE provided an Excel file entitled, "MCE02_05_San Rafael Chamber of Commerce_AUDITS (IN FM).xlsx" that lists 49 audits that occurred from 2014 through Q2 of 2015.

Single Family Program

Table 7-29 presents the Single Family program non-resource accomplishments of MCE as presented in its 2014 Annual Report. This program uses three strategies to provide information to homeowners about ways to save energy: My Energy Tool, Home Utility Reports, and the Schools Program. Using databases supplied by MCE, the exact counts of the number of My Energy Action Tool action plans, registered tool users, recipients of Home Energy Reports, and engagement with students through the Schools program could not be replicated. However, in most cases, larger quantities were found thereby surpassing accomplishments listed in the Annual Report. Differences in the quantities for the various non-resource accomplishments may exist because entries in the databases may have changed contents from when the accomplishments were reported in the Annual Report to when they were provided to the evaluation team.

Table 7-29: Selected MCE Single Family Non-Resource Accomplishments from 2014 Annual Report

MCE SF Non-Resource Accomplishments for 2013-14 from Annual Report	Verified Accomplishments for 2013-2014	Verified Accomplishments for Q1 and Q2 2015
My Energy Tool		
Generated 799 new Action Plans which brought the number to 1,479	MCE provided data ¹ to show that 1,849 Action Plans were created in 2013-14. Multiple plans could be created by a single customer.	A total of 424 Action Plans were created in 2015 through the month of August.
Added 758 new registered users to the My Energy Tool website bringing the total number of users to 2,146	Total number of registrants based on the data provided by MCE ¹ is 763. Total number of users was not verified.	Data for new registrants in 2015 were not provided.
Home Utility Reports		
Expanded the number of customers receiving the reports to over 18,000	Based on the MCE data provided, ² HUR reports are sent out to over 21,000 customers.	No accomplishment provided.
Schools Program		
Engaged with 4,385 students, which led to the creation of 556 Action Plans	MCE's data ¹ shows 609 Action Plans created by accounts denoted as type "SCHOOL". Unable to verify how many students MCE engaged with. These are a subset of the total Action Plans created in My Energy Tool	No "SCHOOL" type accounts were created in 2015 based on the data provided by MCE ¹

1 My Energy Tool data was provided by MCE in an Excel file called "MCE03_01_MCE - My Energy Tool - Registration Tracking.xlsx". Number of Action Plans created was based on the field "Run Date" and unique customer IDs were used to determine number of My Energy Tool users.

2 A number of Excel files were provided by MCE and used to verify customers who receive Home Utility Reports. Counts of customers was based on the total number of unique customer IDs in the following Excel files: HUR1_treatment_demographics.csv, HUR2m_treatment_demographics.csv, HUR2q_treatment_demographics.csv, and HUR3_treatment_demographics.csv. Together, these databases show 21,122 unique customer IDs that have been included in the treatment groups and thus have received Home Utility Reports on either a monthly, bimonthly, or quarterly basis during the 2013-14 period.

MCE supplied additional, and in some cases incremental, non-resource accomplishments and supporting databases about its Single Family program in its response to the data request submitted by the evaluation team. As Table 7-30 shows, the data provided by MCE verified larger quantities of action plans created by individuals or those affiliated with the Schools program. In 2013, MCE stated that users of My Energy Tool created 680 new action plans (as a subset of the 799 that they stated were developed over the 2013-14 program years). Based on the data provided, the evaluation team found that 735 action plans were created in 2013 (see row 2). MCE stated that 281 action plans were created in 2013 as a result of school outreach while the database was used to verify the creation of a total of 338 plans (row 5).

Some of the accomplishments related to mailing of Home Utility Reports and number of new registered users of My Energy Tool were not replicable and came in below the accomplishment provided by MCE. For example, the number of new registered users of My Energy Tool in 2013 was noted to be 1,388 but the database shows 958 unique customer IDs who signed up with the tool in 2013 (row 3).

Table 7-30: Selected MCE Single Family Program Accomplishments Provided by MCE

MCE Single Family Non-Resource Accomplishments from MCE	Verification of Accomplishments
2013	
Generated 680 new Action Plans	Based on the data provided by MCE, ¹ 735 Action Plans were created in 2013.
Added 1,388 new registered users to the My Energy Tool website	Based on MCE’s data, ¹ 958 unique customer IDs were found to have signed up with My Energy Tool in 2013.
Launched the HUR program sending the first mailers in December to 4,424 customers	Data provided by MCE ² show 3,732 recipients of the first HUR mailers in 2013.
School program reached 1,037 students through classroom curriculum and received 281 Action Plans as a result of the school outreach	Data from MCE ¹ show the creation of 338 Action Plans from customer accounts noted as type “SCHOOL”.
2015	
Launched a financing market place on My Energy Tool	No data provided to support this accomplishment
Updated housing characteristics data in My Energy Tool to include new MCE Communities of Unincorporated Napa, Benicia, San Pablo and El Cerrito	No data provided to support this accomplishment.
Generated 173 new Action Plans	Based on MCE’s data, ¹ 424 Action Plans were created in 2015 through August.
Added 187 new registered users to the My Energy Tool website	Data for new registrants in 2015 were not provided.

1 My Energy Tool data was provided by MCE in an Excel file called “MCE03_01_MCE - My Energy Tool - Registration Tracking.xlsx”. Number of Action Plans created was based on the field “Run Date”, the field “Type” was used to determine which accounts are affiliated with schools, and unique customer IDs were used to determine number of My Energy Tool users.

2 Customers who were included in the first set of HUR mailers were included in MCE’s response to the evaluation team’s data request. The file in which these customers are listed is “HUR1_treatment_demographics.csv” and the number of customers was based on unique Customer IDs listed.

Financing Program

No verification of non-resource accomplishments, merging of datasets to CPUC tracking data, or evaluability of non-resource program data is being conducted for MCE’s Financing program. Appendix B provides selected non-resource accomplishments of MCE’s financing program as presented in its Annual Report and provided directly to the evaluation team in response to the data request that was submitted in support of this impact assessment.

7.3.2 Evaluability of Databases

MCE provided 35 Excel files that contained the data used to verify the non-resource accomplishments presented in the above subsection. Of these files, seven were assessed for quality, completeness, and consistency of:

- Contact information (names, addresses, and phone numbers),
- Merging variables (account numbers and customer IDs), and
- Details about recommendations, referrals, and/or attendance at workshops or events.

A subset of the total number of databases provided was selected because not all of the files would be useful in a more detailed evaluation of impacts that stem from non-resource activities. The seven files that were evaluated are as follows with descriptions of their contents:

- *MCE01_05_MF Pipeline Database Revised 9 14.xlsx, Tab names: 2013-2014 and 2015 Dashboard*; the 2013-2014 tab provides records of 28 multifamily properties that have received technical assistance, direct install measures, and pipe wrapping in 2013-2014; the 2015 Dashboard tab contains 54 multifamily properties which received technical assistance in 2014-2015. Fifteen of the 2014 properties are listed on both tabs.
 - *Tab 2013-2014:*
 - Fields provided on this tab include: project number, property name, county/city location, number of buildings, number of units, year in which the property was assessed, number of units in which direct install measures were installed, and number of units in which pipe wrapping was installed.
 - A total number of units that received technical assistance is presented as a subtotal of the number of units presented in the table. No explanation is provided as to why all of the units are not included.
 - No contact information is listed for the properties that were provided with technical assistance in 2013 (and it is only available for 15 properties that received technical assistance in 2014 on the second tab in this workbook). Property names are not provided in a consistent format (names of properties are sometimes listed, and other times descriptions of the property location are included). For most of the properties, dates of assessment (year of assessment) have been provided. Minimal data are available for the properties that received technical assistance in 2013-14.
 - The database contains no electric and gas service account IDs, therefore merges of data to CIS, billing, and CPUC tracking data cannot be carried out.

- *Tab name: 2015 Dashboard*
 - Though the tab name is 2015 Dashboard, the tab includes properties assessed in 2014 and 2015. Data fields for the 17 properties assisted in 2014 include name of property, owner/manager of property, property manager, address, e-mail, phone, number of units, number of buildings, year built, and whether the property is classified as “affordable” or “market”. All fields are completed with no missing data.
 - The same data fields are available for the 36 2015 properties as are available for the 2014 properties with the addition of time and date of initial call, date on which a “good faith deposit” was made, date deposited, amount of deposit, check number, site assessment date, date added to dashboard, date assessment report sent, kWh savings potential, therm savings potential, and rebate potential. While data for properties that were provided technical assistance in 2015 is available, it is unclear how many units actually received this assistance. The total provided in this file removes certain units and it is not clear why these were removed.
 - The database contains no electric and gas service account IDs, therefore merges of data to CIS, billing, and CPUC tracking data cannot be easily be carried out.
- Overall, the key variables necessary for contacting property managers in the future are being collected and are moderately populated, but only for 2014 and 2015 records. Service account numbers are not being collected that would allow for a direct merge to CIS and IOU tracking data. Information on recommendations that may be developed as part of the assessments are not being tracked. There are also calculations being made within the spreadsheet used for tracking technical assistance accomplishments that are not well documented.
- *MCE02_01_EF_CombinedmarinCleanEnergy_auditConducted_greaterThanJan1-2013.xlsx*, a database that contains 1,779 records for 668 unique electric SAIDs for small commercial customers that have received audits and/or site assessments.
 - Some of the key variables in the database are: vendor transaction ID, master SAID, electric SAID, business/customer name, site contact name, site address, site phone number, flag for whether the customer is participating in on-bill financing, various dates related to site assessment dates, project commitment dates, vendor inspection dates, measure recommendations descriptions, quantities, potential energy savings, and measure costs.
 - There are approximately 50 different measures installed in commercial buildings (some of which were free through the site assessments).
 - Each record denotes an assessment (i.e., site visit) or audit that has occurred and some properties are listed more than once as they have had multiple audits. As noted

by MCE, multiple "audit" reports may be generated for a single site. For example, if the customer has lighting and refrigeration and HVAC opportunities, those would each constitute a unique "audit".

- The fields are moderately well populated. Of the 1,779 records, there are no blank business names, 28 blank phone numbers (which only represent 13 customers), no blank addresses, and 10 blank measure names. There are a significant number of master SAIDs missing (355) and electric SAIDs missing (403).
 - The availability of SAIDs does allow for merging with other data sources that would assist in impact evaluation work, however, there are a number of records which are missing this information, as stated above.
 - Overall, the key variables necessary for contacting customers in the future are being collected and are moderately well populated. Service account numbers are being collected for the majority of records that would allow for a direct merge to CIS and IOU tracking data. Detailed information on recommendations are being tracked, although it is not clear if the recommendation was a result of an audit or site assessment.
- *MCE03_01_MCE - My Energy Tool - Registration Tracking.xlsx*, a database that contains 6,650 records of customers who signed up to use My Energy Tool and those who have created Energy Plans using the tool.
 - Salient fields included in the database are: e-mail address, a 0/1 flag to show whether the customer has linked his/her login to his/her PG&E account, square footage, year home constructed, city, zip, date on which customer signed up for My Energy Tool, last login, Schools program group name (if applicable), program type (value may be either "SCHOOL", "COMPANY", "Demand Response", or blank), 0/1 flag to denote whether customer is part of the Smart Device (thermostat) program, segment (which type of action plan was selected – options are "carbon-net-zero", "health-comfort", or "max-roi"), calculation ID (of energy plan run), run time (time/date of energy plan run), number of actions recommended, recommendations, savings (\$) estimated for the lifetime of the equipment, and a variety of indicators to show whether customers noted that they are or are not interested in the recommendations made.
 - Note that there are 1,684 unique customer IDs which means that some customers have run the tool multiple times to generate energy action plans. Each record in the database represents the creation of an energy action plan.
 - Based on the data, 5,137 action plans (by 494 unique customers IDs) have been linked to a PG&E account which would help facilitate the merging of these data to CIS, billing, and CPUC tracking data. This represents approximately 30% of customers who used the tool to create Action Plans. Identifying the PG&E accounts numbers and merging this database to other databases, such as CPUC tracking data,

would allow an examination of equipment recommendations made in Action Plans and determine whether customers have purchased the recommended equipment through a PG&E energy efficiency rebate program.

- Overall, the only variables being collected that can be used to contact customers is the e-mail address. It would be useful to try to gather phone numbers and addresses, although some of these can be obtained by merging onto IOU data. Service account numbers are being collected for the 30% of records that would allow for a direct merge to CIS and IOU tracking data. Detailed information on recommendations are also being tracked. The database is also tracking the customer's reported interest in a recommendation, and if a recommendation was completed. However, it is not clear if the completed recommendation was already done prior to the recommendation being made, or done as a result of the recommendation. This delineation would be very useful to gather.
- *HUR1_treatment_demographics.csv (3,732 records), HUR2m_treatment_demographics.csv (6,559 records), HUR2q_treatment_demographics.csv (6,607 records), HUR3_treatment_demographics.csv (4,234 records)*, a set of databases that includes recipients of Home Utility Reports
 - Each of these tables include the following fields: customer ID, latitude, longitude, square footage, number of occupants, rate schedule, number of bedrooms, number of bathrooms, city, zip, year constructed, whether home is owned or rented, dwelling type, number of children, number of adults, whether the home has a pool, and variables to indicate whether the property has heating and/or cooling.
 - The data are presented in a consistent format and all variables are very well populated.
 - There is a customer ID, but the evaluation team is unsure if it can be used to link back to any CIS, billing, or CPUC tracking data.
 - Overall, the key variables necessary for contacting customers were not provided, however the Customer ID field would allow the records to be merged to gather whatever contact information MCE has on their customer. The report refers the customer to their action plan which is part of My Energy Tool discussed above.

In summary, contact information is being collected moderately well, but there is improvement that can be made, as suggested by the evaluation team. For activities that result in recommendations, the databases provide a wealth of information that would be useful for evaluators. However, the structure and format for some of the databases could be modified to improve their usability.

For example, a review of the multifamily technical assistance database showed that the data fields were poorly labeled, data within fields were not consistent, and information about why certain properties were not included in the totals that were given technical assistance was not provided. This dataset could be improved by entering data in a consistent manner, tracking dates on which assistance was provided, and ideally linking the few records to electric and gas SAIDs. Other recommendations to improve the usability of the datasets include either clearer variable names or a data dictionary documenting key variables, documenting calculations done within the workbooks, and performing calculations that can be done more globally that would not require formulas to be updated every time new records are added (e.g., instead of having a formula that sums three specific cells in a column, have the entire column summed up that interacts with an indicator variable that identifies if the record should be included in the sum).

The databases that track usage of My Energy Tool and the recipients of Home Utility Reports are both well populated and data are tracked consistently for the variables included. It would be particularly useful if these databases also included names, addresses, and phone numbers to support impact evaluation work through surveys. These surveys could be implemented to determine if customers are using the recommendations made in the Energy Plans generated from the tool or in the Home Utility Reports that have been sent out. Finally, if customers identify that they have completed a recommendation from their action plan, it would be helpful to have them report if the action was done as a result of the recommendation.

7.3.3 Results of CPUC Tracking Data Merges

Two databases were used to merge to CPUC tracking data to see if customers who interacted with MCE went on to participate in any California PA energy efficiency resource programs. The first dataset lists customers who received audits and participated in MCE's Small Commercial program and the second contains a list of multifamily properties that received direct install measures through its offering of Technical Assistance.

Merging MCE Small Commercial EF Records

The customer information for MCE Small Commercial Assessment program component came from Excel workbook "MCE02_01_EF_CombinedmarinCleanEnergy_auditConducted_greaterThanJan1-2013.xlsx". The file lists Vendor Transaction ID, Account ID, Electricity and Gas SAID, Customer Name, Contact First and Last Name, Customer Phone Number, Contact Phone Number, Service Address, City and ZIP Code, Site Address, City and ZIP Code, along with a data on recommended energy efficiency measures.

There are 1,779 observations and 1,163 unique transaction IDs in the dataset. Many transaction IDs had more than one record with different measure information associated with them. Since this task was to match all possible projects from the tracking data for each MCE Small

Commercial site, the merging was completed at the project ID level, ignoring the differences in measure information.

The MCE data was merged to the tracking data by (1) Account ID and service account ID, (2) addresses, (3) names, and (4) phone numbers. The number of unique transaction IDs left after each step of merging are listed in Table 7-31 below. After each merging step, the merged records were manually checked to make sure that the site listed in MCE’s records is the same site as the one merged from the tracking data.

Table 7-31: Merging Steps of MCE Small Commercial Assessment/Audit Program Database to Tracking Data

Merge Steps	# Transaction IDs Left	% Left
RawData	1,163	100%
After Account Merge	708	61%
After Address Merge	679	58%
After Name Merge	666	57%
After Phone Merge	666	57%

1. Merge by Service Account ID: MCE Small Commercial Assessment (MCE Small Com) program data records were merged to the tracking data by service account ID. The MCE Small Com dataset provided account ID, electric service account IDs (SAIDs) and gas SAIDs, but the electric and gas SAID variables were sometimes confused with the account ID, which is a completely different identifier. Fortunately, PG&E’s service account IDs and their account IDs have the same first several digits. Therefore, MCE Small Com records were merged to the tracking data by the first several digits of the account ID, and then the merged records were checked manually to verify if the two parts had the same addresses. Overall, 455 records were merged in this step.
2. Merge by Address: MCE Small Com data were merged to the tracking data by address. The merge was considered valid if the two fields had the same city/zip and name information. The names from MCE Small Com records and the tracking data were manually checked to match the names that were differently spelled. Overall, 29 observations were merged in this step.
3. Merge by Name: MCE Small Com records were merged to the tracking data by names. MCE Small Com data provided three sets of name variables: customer name, site contact first name and last name, and property owner first name and last name. All three sets of the name variables were used in attempts to merge the tracking data, and both first name + last name and last name + comma + first name formats were tried too. Then the merges were checked manually to determine if the addresses were matched. If so, the merge was considered valid. Overall, 13 observations were merged in this step.

4. Merge by Phone Number: MCE Small Com records were merged to the tracking data by phone numbers. Again the merge were checked manually to determine if the addresses were matched. No extra observations were merged in this step; all were covered in the earlier steps.

MCE Small Com program data provided a substantial number of service account IDs, which simplified the merging process. Although there was no e-mail information available, the data provided addresses, names and phone numbers. One issue that was noted is that when the two datasets could be merged by service account ID, there were some cases where the addresses of the two datasets did not match. It is not certain that these were completely valid merges. Based on all sequential merge steps taken, 497 IDs could merge to the CPUC tracking data.

A summary of the number of MCE Small Commercial Assessment/Audit transaction IDs and unique sites that merged with resource program claims in CPUC tracking data can be seen in Table 7-32. This table breaks down the number of transaction IDs and unique sites that merged back up to MCE claims and the number that merged up to PG&E resource claims as a way to determine how much of an effect the assessments and audits provided to MCE customers has had in leading them towards resource activities offered by the PAs. Based on the findings below, 363 of the 588 transaction IDs and 318 of the 451 sites were successfully merged to PG&E claims in the tracking data. This shows very positive support for the effect of this non-resource activity on generating energy savings through CA PA energy efficiency programs.

Again, it is important to remember that the number of merged IDs in Table 7-32 exceeds the number described above (497 IDs) because a single customer may be involved in multiple MCE and/or PG&E claims.

Table 7-32: Number of MCE Small Commercial Assessment/Audit Program Observations and Sites Merged to Tracking Data

PA	# of IDs	# of Sites
MCE	225	133
PG&E	363	318
Total	588	451

Merging MCE MF Pipeline Records

The customer information for MCE MF Pipeline program came from an Excel workbook provided by MCE called “MCE01_05_MF Pipeline Database Revised 9 14.xlsx”. The workbook listed project name, manager name, building owner’s name, phone number, service address, city and zip code, and contact e-mail address. There are 70 observations in the dataset, and 68 unique ID numbers. Two IDs had two observations each, with project names being phase

1 and phase 2, and the site information the same. Therefore, the merge was done at the site level, ignoring the project phase.

The dataset was merged to the tracking dataset by (1) addresses, (2) names, (3) phone numbers and (4) e-mail addresses. The number of unique IDs left after each merging step are listed in Table 7-33 below. After each step, the merged records were manually checked to make sure that the site listed in MCE’s records is the same site as the one merged from the tracking data.

Table 7-33: Merging Steps of MCE Multifamily Pipeline Program Database to Tracking Data

Merge Steps	# Obs Left	# IDs Left	% Left
RawData	68	68	100%
After Address Merge	62	62	91%
After Name Merge	61	61	90%
After Phone Merge	61	61	90%
After E-Mail Merge	61	61	90%

1. Merge by Address: MCE MF Pipeline program data records were merged to the tracking data by address. The names from MCE MF Pipeline records and the tracking data were manually checked to match the names that were differently spelled. Overall, six observations were merged in this step.
2. Merge by Name: MCE MF Pipeline program data records were merged to the tracking data by names. MCE MF Pipeline data provided three name variables: owner name, manager name, and project manager name. A record was merged to the tracking data if either of the variables matched the name variables in the tracking data. Then the merges were checked manually to determine if the addresses matched. If so, the merge was considered valid. Overall, only 1 observation was merged in this step.
3. Merge by Phone Number: MCE MF Pipeline program data records were merged to the tracking data by phone numbers. Again the merge were checked manually to determine if the addresses were matched. No observations were merged in this step.
4. Merge by Email Address: MCE MF Pipeline program data records were merged to the tracking data by e-mail address. Again the merges were checked manually to determine if the addresses were matched. No new observations were merged in this step, but some observations that got merged in earlier steps found new matched records in the tracking data.

The success of merging this dataset to the CPUC tracking data was hampered by the fact that the MCE MF Com data did not provide the service account ID, and 15 out of 68 of the IDs listed in the MF dataset did not have any customer and/or site information. The addresses in the dataset

had street addresses, cities, and zip codes all together, if available, and there were many cities and zip codes missing. It took some time and effort to clean up the addresses. The name variables included owner name, manager name and project manager name, but no property names. The data sometimes used the property names as the project name, but not consistently. The CPUC tracking data always included the company name, which in the case of multifamily customers are the property name. While there was incomplete data, MCE’s dataset provided good information on phone number and the e-mail addresses.

A summary of the number of MCE Multifamily Pipeline customer IDs and unique sites that merged with resource program claims in CPUC tracking data can be seen in Table 7-34. This table breaks down the number of IDs and unique sites that merged back up to MCE claims and the number that merged up to PG&E resource claims as a way to determine how much of an effect the multifamily program activities carried out by MCE customers has had in leading them towards resource activities offered by the PAs. Based on the findings below, four of the seven IDs and three of the 12 sites were successfully merged to PG&E claims in the tracking data. This shows some support for the effect of this MCE program on generating energy savings through CA PA energy efficiency programs.

Table 7-34: Number of MCE Multifamily Pipeline IDs and Sites Merged to Tracking Data

PA	# of IDs	# of Sites
MCE	3	3
PG&E	4	9
Total	7	12

7.4 Conclusions and Recommendations

Conclusion Non-Resource-1 [MCE, BayREN, SoCalREN]: The accomplishments documented in each PA’s annual report are reasonably reliable and do not tend to overstate what they have achieved. Generally speaking, BayREN’s Single Family Home Upgrade and Multifamily Upgrade non-resource accomplishments for 2013-14 could be verified. Using the supporting databases and information provided by BayREN, a verification of most of its Single Family Home Upgrade program and Multifamily Upgrade non-resource accomplishments could be conducted using the supporting databases and information provided. There was mixed success in verifying SoCalREN’s and MCE’s non-resource accomplishments for their programs and services. In some cases, the databases supported the non-resource accomplishments by showing the same or a larger quantity of activities than were stated in the accomplishments. In other cases, there were fewer activities found in the datasets provided than what was claimed in the non-resource accomplishment.

Recommendation Non-Resource-1 [MCE, BayREN, SoCalREN]: The RENs and MCE should archive copies of the databases from which the accomplishments are taken when non-resource accomplishments are reported so that all accomplishments can be verified in the future.

Conclusion Non-Resource-2 [MCE, BayREN, SoCalREN]: The databases provided by the RENs and MCE are generally collecting the necessary data to support future evaluations, although more complete information would improve the evaluability of their non-resource efforts. More complete contact information, such as names, phone numbers, addresses and e-mails allow customers to be contacted in the future, and increase the chances of data records being able to be merged to CPUC tracking data, and utility CIS and billing data. Databases where SAIDs are available make it easier to merge records to other data sources, such as CPUC tracking and CIS data. It is also important to attempt to track when customers go on to participate in IOU programs as a result of the various non-resource efforts, as well as document the recommendations that are provided as a result of audits and assessments. This would help support an attribution analysis of the influence of the PA's efforts on other energy efficiency adoptions that are not made through their programs.

Recommendation Non-Resource-2 [MCE, BayREN, SoCalREN]: The RENs and MCE should attempt to gather key contact information, electric and gas SAIDs, and document audit/assessment recommendations and participation in other programs whenever possible and relevant. For MCE's My Energy Tool, if customers identify that they have completed a recommendation from their action plan, we suggest the tool ask the customer to report if the action was done as a result of the recommendation.

Conclusion Non-Resource-3 [MCE, BayREN, SoCalREN]: MCE and BayREN have a unique customer identifier, but it is not used in all of their customer databases, and SoCalREN does not have a unique customer identifier. A unique customer identifier that is tracked in all customer related databases would allow for datasets to be easily merged and would allow for the development of a centralized database by customer ID containing key information.

Recommendation Non-Resource-3 [MCE, BayREN, SoCalREN]: MCE and BayREN should track their unique customer identifier on all customer related databases, and SoCalREN should develop a unique customer identifier that is assigned to every customer as they come into contact with someone. Furthermore, a database should be developed that is a centralized repository for all customers and contains key information such as contact information, SAIDs, participation information, and information on other activities that the customer has been involved with.

Conclusion Non-Resource-4 [MCE, BayREN, SoCalREN]: The quality of the RENs' and MCE's non-resource databases reviewed was inconsistent. While some databases were very

easy to use, understand and navigate, others required more effort to analyze and understand. For example, in some instances data fields were poorly labeled, data within fields were not consistent, and information on how some accomplishments were calculated were not documented.

Recommendation Non-Resource-4 [MCE, BayREN, SoCalREN]: The RENs and MCE should consider reviewing the structure, format, and contents of their databases to improve consistency and usability; developing a data dictionary documenting variable names (with the exception of SoCalREN, who provided data dictionaries with all provided datasets); and documenting calculations. Some datasets could be improved by entering data in a consistent manner, tracking dates on which various activities occurred, and attempting to link records to electric and gas SAIDs. Other recommendations to improve the usability of the datasets include creating clearer variable names, developing a data dictionary documenting key variables, documenting calculations done within the workbooks, and performing calculations that can be done more globally that would not require formulas to be updated every time new records are added (e.g., instead of having a formula that sums three specific cells in a column, have the entire column summed up that interacts with an indicator variable that identifies if the record should be included in the sum).

Conclusion Non-Resource-5 [MCE, BayREN, SoCalREN]: The ability to merge the REN's and MCE's databases that track non-resource accomplishments related to energy audits, referrals, site visits, and advisor hotlines to CPUC tracking data is based on the collection of variables that can be used to link the records across sources, such as electric and/or gas service account IDs. Though the databases often include customer name, and sometimes address, phone number, and/or e-mail, they do not always include electric and/or gas service code account IDs because these variables are not always easy to gather when conducting non-resource activities such as marketing, outreach, advisement, and training.

Recommendation Non-Resource-5 [MCE, BayREN, SoCalREN]: The RENs and MCE should record names, addresses, phone numbers, and e-mail addresses in a consistent format, and collect IOU customer account IDs and service account IDs whenever possible, as part of their non-resource tracking systems in order to increase the ability to merge non-resource tracking records to CPUC tracking data. Collecting names, addresses, phone numbers, and e-mail addresses in a consistent format helps to simplify data cleaning steps that are taken before attempting merges, and IOU customer and service account numbers significantly increase the likelihood of merges.

Conclusion Non-Resource-6 [MCE, BayREN, SoCalREN]: The results of the merge for a sample of non-resource databases provide some evidence that the RENs and MCE are influencing customers to participate in IOU energy efficiency programs. The number of records that merged to IOU program tracking data was on the order of the number of participants

participating in the REN/MCE programs.⁷² Therefore, there is evidence that REN and MCE non-resource activities have the potential to influence IOU participants. The magnitude of this effect could be significant relative to amount of participation occurring in each of the REN and MCE resource programs. However, these activities likely have a negligible effect relative to the amount of participation occurring in the IOU programs that they may be influencing. It is also important to note that a complete assessment of all non-resource efforts was not made. Also, no effort was made to identify what influence these programs have had on adoptions made outside of IOU programs (or intentions to adopt measures), which was outside the scope of this project, but could be another topic for a future evaluation.

Recommendation Non-Resource-6 [MCE, BayREN, SoCalREN]: Future evaluations of the RENs and MCE could replicate this analysis with additional program years and non-resource databases and attempt an attribution analysis in order to quantify the benefits of the non-resource activities. Furthermore, if the PAs collected more data to support this analysis as discussed in previous recommendations, it would improve the results for this activity. Future evaluations could also attempt to identify what influence these programs have had on intentions and/or on adoptions made outside of IOU programs.

⁷² For example, 734 single family site IDs in BayREN's Home Upgrade Advisor tracking data merged to PG&E's resource program tracking data. This compares to BayREN's 684 participants in their single family program.

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Appendices

- A. MF and Commercial Survey instruments
- B. Non-Resource Accomplishments of Codes and Standards and Financing Programs of RENs and CCA
- C. Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers

NOTE: Due to the file size, the appendices have been made available as a separate PDF. This version of the report simply includes a cover sheet for the appendices.