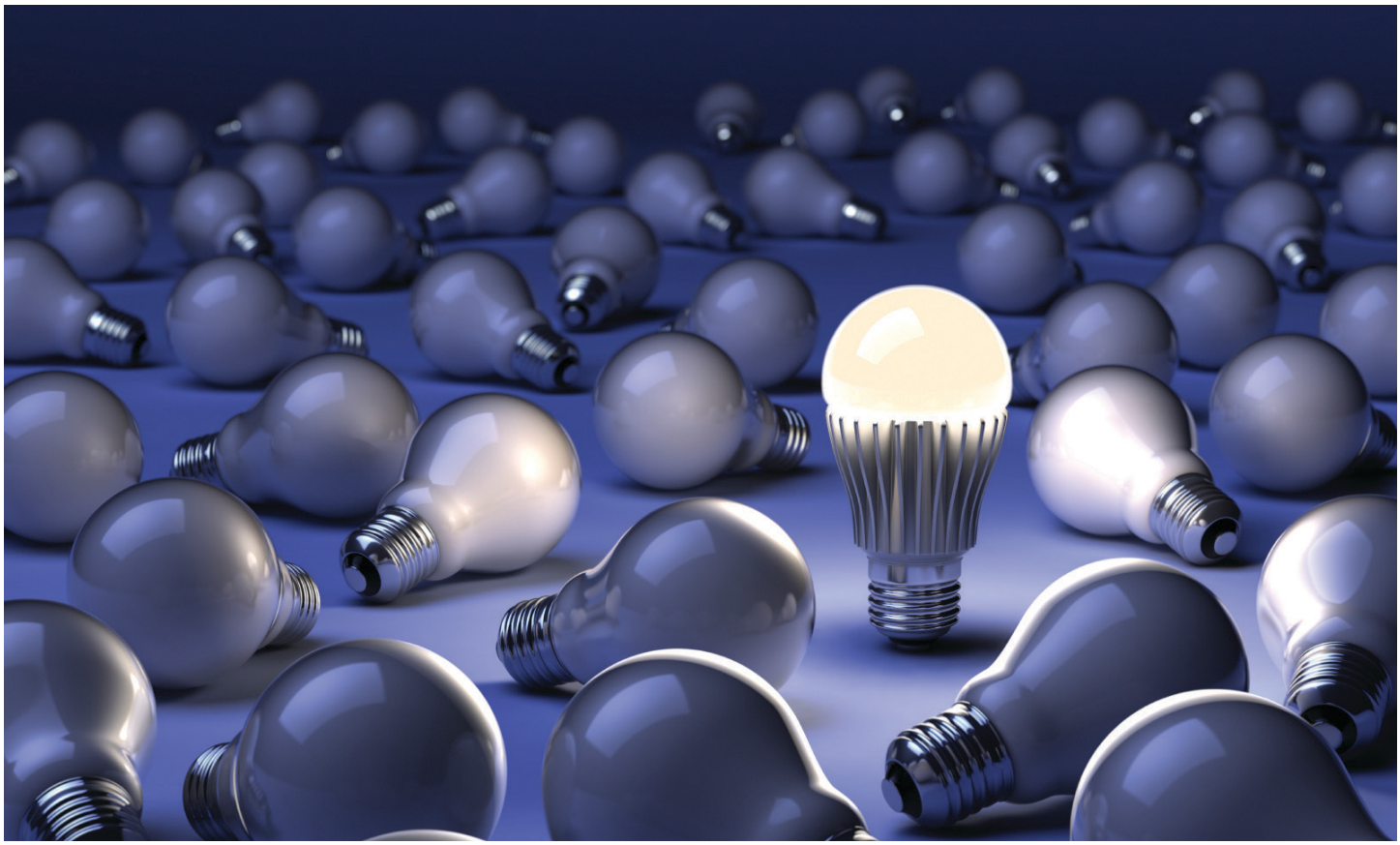

California Public Utilities Commission

2010 – 2012 Energy Efficiency Annual Progress Evaluation Report

March 2015

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Executive Summary

Objectives and Scope of This Report

The California Public Utilities Commission's (CPUC) Energy Efficiency Evaluation Report summarizes the achievements of California's investor-owned utilities' (IOUs')[1] 2010-2012 energy efficiency portfolio,[2] based on evaluation studies fielded during the three-year program cycle.[3] The IOUs are responsible for implementing energy efficiency programs and the CPUC is responsible for overseeing and evaluating these activities to inform future policy direction, improve program design and refine savings estimates.[4]

The CPUC approves a portfolio of energy efficiency programs on a two or three year cycle. This report summarizes the most recently completed cycle, which started January 1, 2010 and ended December 31, 2012.

1 The CPUC regulates California's four investor owned utilities, including Pacific Gas & Electric (PG&E), Southern California Edison (SCE), San Diego Gas & Electric (SDG&E) and Southern California Gas (SoCal Gas).

2 The energy efficiency portfolio is the total combination of energy efficiency programs (including technologies and activities), anticipated savings and planned budget for a given 2 or 3 year cycle. See "D. 09-09-047" http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/

3 ED is responsible for conducting a large amount of primary research and evaluation for energy efficiency programs supported by the CPUC and implemented by California's investor-owned utilities. Evaluation and research efforts include savings measurement and verification, program evaluation, market assessment, policy planning and support, and financial and management audit. See "2010-2012 EM&V Work Plan," available at http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/

4 D.09-09-047 authorizing the 2010-2012 energy efficiency portfolio authorized funding for evaluation research overseen by Energy Division and executed by both Energy Division and the Investor Owned Utilities, as further outlined in D.10-04-029.

This report describes progress made by the IOUs in fulfilling Commission policy and meeting goals established for current and future program cycles. It also tracks the impacts of the IOUs' energy efficiency activities towards meeting multiple statewide energy and climate policy objectives including making preferred energy resources like efficiency a reliable resource per the Energy Action Plan (the EAP), greenhouse gas mitigation goals per AB 32, and the California Energy Efficiency Strategic Plan (the Strategic Plan or the Plan).

This report is a synthesis and summary of results from more than 80 studies conducted across a subset of more than 200 programs that constitute the 2010-2012 portfolios of energy efficiency activities and target residential and non-residential customers within the IOUs service territories. The measure level results are compiled into a single database to show the effect of evaluated savings and program impacts at the program, sector and utility level.[5] Evaluation activities reviewed approximately 75 percent of claimed savings in order to verify the claims and update them based on information found in the field and improve our understanding of specific program models and market conditions. Each detailed study is actively informing current program development as IOU and CPUC staffs take action on findings and recommendations embedded in the studies related to their respective activities, markets, and technologies.

Finally, research findings are best understood in the context of the full research. Given the summary nature of this report, readers are encouraged to return to the original source documents (including research plans and final project reports) for a more comprehensive treatment of the material summarized in this report. References to the original research are provided throughout the report.

Energy efficiency in California has long been guided by rigorous field evaluations conducted by third party nationally-recognized evaluators. These field evaluations by independent third parties collect information about how well an energy efficiency technology was installed, how it performed in the field, and the likely influence of the program on any resulting change in energy use. As a result, the information collected from the field typically results in differences between reported changes and evaluated results, as program planning assumptions are adjusted to account for evaluation results. The values provided in this report focus on the evaluated savings estimates for electricity, peak demand and natural gas, as well related cost effectiveness for individual technologies, customer sectors, each IOU, and for the portfolio as a whole.

The CPUC sets goals and cost-effectiveness thresholds for the IOUs at the portfolio level, not at the sector, program, or technology level. The portfolio cost effectiveness information is provided to shed light on relative cost effectiveness; as each utility portfolio is required to meet a cost effectiveness threshold of 1.0 or greater. The IOUs have flexibility in how they organize the efficiency portfolio to achieve the goals and cost-effectiveness, while simultaneously "seeding" programs and technologies that are currently not cost-effective but show promise to become so in the future[6].

5 The datasets are publicly available in the appendices of this report as well as in an interactive format on Energy Efficiency Stats website data portal: http://eestats.cpuc.ca.gov

6 Each IOU portfolio must be cost-effective on the whole, but include some programs/measures that may not be cost-effective as they focus on long-term energy savings and market transformation activities.

The comparison between the IOU reported and evaluated savings estimates is provided in Appendix A. While important information for understanding which savings estimates may need to be updated, this comparison is not a "regulated metric" used to determine whether the IOUs have achieved the goals established by the CPUC for their portfolios.

Finally, research findings are best understood in the context of the full study. Given the summary nature of this report, readers are encouraged to return to the original source documents (including research plans and final project reports) for a more comprehensive treatment of the material summarized in this report. References to the original research are provided throughout the report.

OVERVIEW

The CPUC authorized $3.1 billion in ratepayer-funded energy efficiency programs for the 2010-2012 program cycle; the IOUs spent approximately $2.5 billion over the three-year cycle.[7] The 2010-2012 energy efficiency activities resulted in:

- approximately 7,745 gigawatt hours (GWh) in electricity savings, enough to power nearly eight hundred thousand homes for a year and potentially offset nearly 1,300 megawatts (MW) of summer peak electricity generation.
- the programs also saved approximately 170 million therms.
- About 63 percent of the savings were directly linked to the influence of the program.
- these direct first-year program savings equal approximately 1% of the IOUs electricity sales.[8]

The energy efficiency savings realized by California customers are estimated to have:

- cut CO_2 emissions by 5.3 million tons, the equivalent of removing over one million cars from California's roads.[9]
- Improvements in the energy efficiency levels of building codes and appliance standards statewide were also achieved through active IOU participation in the regulatory process and added to the benefits.

Additionally, the portfolio of energy efficiency activities for 2010-2012 was cost-effective:

- every dollar invested in non-codes and standards energy efficiency returning $1.04.
- Investments in advocating and supporting codes and standards provided a return of approximately $3.64 on every dollar.
- When combining evaluated savings and savings from Codes and Standards activities, the

7 Unspent funds are allocated to subsequent program cycle funding requirements. See D.12-11-015, section 6.1 " Treatment of Unspent Funds from Prior Portfolio Cycles", at http://www.lgc.org/events/docs/seec/seec_webinar15-2013-14%20EEDecision.pdf

8 CEC report on average California household 400-800 kWh/mo.; take total accomplishments kWh (6,548 GWH)/(800kwh*12) = over 600,000 households powered for a year. The savings realized directly from IOU programs are net savings and are identified as savings that would not have occurred without the IOU programs in place. Gross savings for the 2010-2012 program cycle are nearly double the net savings, and include savings that would have occurred in the absence of the portfolio program efforts. The IOUs' progress with regard to energy savings goals is measured based on gross savings. FERC Form 1 reports filed by the IOUs reveal total sales of approximately 552,500 GWh of electricity over the three-year period.

9 In estimating CO_2 emissions reductions associated with gas and electric savings, Energy Division used the emissions factors that are embedded in the E3 Calculators, which are specific to each technology installed. In estimating the number of cars removed from California roads, ED used the factors presented in D.05-09-045 which approved the IOU programs for 2006-2008 and included an estimate of cars removed (1 car for every 5.26 tons of CO_2)

portfolio cost-effectiveness increased, with every dollar invested returning $1.31.
- This is a total savings of $3.275 billion dollars for the life of the measures installed and the actions taken during this program cycle.

The 2010-2012 energy efficiency portfolio supports the policy objectives of the Energy Action Plan (EAP), which calls on the state to capture all cost-effective energy efficiency and demand response opportunities prior to planning to build additional power plants. The results from this report and the underlying data will be used to inform updates to the California Energy Commission's (CEC) energy demand forecast and long term procurement planning at the CPUC and California Independent System Operator (CAISO). It also directly contributes to achieving complementary policy carbon-reduction goals described in the California Air Resources Board's AB32 Scoping Plan. Several other policy objectives, such as statewide benchmarking mandates, are either directly or indirectly addressed by the IOUs' energy efficiency activities and are noted in this report in each chapter. In addition, the portfolio supports the California Energy Efficiency Strategic Plan (CEESP), which serves as a framework to prime the market for future energy savings opportunities through market transformation activities.

Impacts of the 2010-2012 Energy Efficiency Portfolio

The Commission sets IOU energy savings goals based on market potential studies for energy efficiency technologies and programs. The energy savings goals for the 2010-2012 energy efficiency portfolios were originally established in D.04-09-060. In that decision, the Commission adopted savings targets for each of the utilities for the years 2004-2013 that reflect the expectation that energy efficiency efforts in their combined service territories should be able to capture 70% of the economic potential and 90% of the maximum achievable potential for electric energy savings over the 10-year period. Savings goals were defined as cumulative in D.04-09-060, reaffirmed in D.07-10-032, and adjusted to an annual basis in D.09-05-037.

For the 2010-2012 program implementation period, the Commission allowed the utilities to credit savings from Low Income Energy Efficiency programs and Codes and Standards advocacy toward their goals, although these savings were not included in the savings potential study used to define the goals. Looking just at evaluated IOU program savings, excluding Codes and Standards advocacy and low income program savings, the statewide goals for electricity and natural gas savings were exceeded by 15 percent and 7 percent, respectively, while the achievement of goals set for demand reduction fell short by 12 percent (Table 1) With the inclusion of savings from Codes and Standards advocacy and low income programs, the utilities exceeded the statewide 2010-2012 electric gross savings goals by 52 percent; the demand goals by 15 percent; and the natural gas goals by 23 percent.

The portion of the electric savings achieved through customer-targeted programs and activities was 75 percent, codes and standards activity made up 22 percent and low income activities represented 2 percent. For natural gas, the portion of savings from customer-focused programs was 86 percent, codes and standards 6 percent, and low income 8 percent. The IOUs spent approximately $2.5 billion on energy efficiency program activities for the 2010-2012 program cycle, an additional $30 million on codes and standards advocacy, and approximately $327 million

and $342 million on low income programs in 2010 and 2011, respectively (the three-year low income program cycle spanned 2009-2011). Unspent, uncommitted funds from the program cycle's authorized funding of $3.1 billion were carried over to reduce the revenue requirement needed to fund the 2013-2014 portfolios.

Table 1. Evaluated Savings, 2010-2012 program cycle[10]

		Energy Savings			Cost Effectiveness
		Electric (GWh)	Demand (MW)	Natural Gas (MM Therms)	TRC
Goals	Gross	6,966	1,537	150	
Reported	Gross	9,167	1,657	155	
	Net	6,416	1,177	102	1.43
Evaluated	Gross	7,745	1,308	173	
	Net	4,923	844	94	1.04
Codes and Standards	Net	2,281	343	11	3.64
Evaluated Savings Including Codes and Standards		10,026	1,651	184	1.31
Low Income	Reported	237	59	14	
Evaluated Including C&S and Low Income		10,263	1,710	197	
Evaluated Gross Savings V. Goals		111%	85%	115%	
Evaluated Gross, C&S and Reported LI V. Goals		147%	111%	132%	

10 The utilities are accountable for achieving the total portfolio goals defined by the Commission (in D.09-09-47 for the 2010-2012 program period) and ensuring the portfolio is cost-effective, but have flexibility at the sector/program level that means any given program or even sector (as presented in this report) may not meet the *projected* savings target or be cost-effective for a variety of reasons. Reported savings represent what has been installed to date, but does not represent evaluated results. Codes and Standards are net savings expected.

The CPUC oversees the implementation of a joint evaluation plan with the IOUs. The 2010-2012 evaluation plan allocated four percent of the authorized program cycle budget for more than 80 evaluation studies administered by the Commission and the IOUs that addressed key research needs.[11] The studies focused on four core research areas:

1. **Savings measurement** and verification of energy efficiency measures and programs which inform core metrics of savings against goals, and cost-effectiveness, as well as developing reliable estimates of load impacts.
2. **Program evaluation** of specific qualitative and quantitative factors of performance, to inform improvements in program design and supporting forward-looking corrections to utility programs and portfolios.
3. **Market assessments** that gauge current market situations that inform savings baselines, identify and track appropriate baseline metrics of market change, measure progress toward achieving long term Strategic Plan objectives, and inform estimates of remaining potential for energy efficiency.
4. **Policy and planning support** that include overarching studies to inform Commission policy.

All completed studies are cited in this report and are available on line in the evaluation report archive: www.calmac.org.

Defining Success

Based on CPUC direction for the 2010-2012 portfolio, per legislative mandate, the portfolio is considered successful if it is cost-effective[12] and meets all of the CPUC's savings goals. The CPUC also directed IOUs to support the Strategic Plan, which requires a more nuanced assessment of success, such as achieving longer term market transformation goals and strategic objectives. The 2010-2012 portfolio reflects a balance of these shorter and longer term priorities, leveraging cost-effective drivers of energy efficiency (e.g., industrial programs and lighting) to support programs that, while not cost-effective today, have the potential to drive substantial savings in the future (e.g., zero net energy building pilot programs).

For the 2010-2012 program cycle, the portfolio's cost effectiveness, determined by comparing the benefits derived from energy savings to costs incurred by program participants and the IOUs, was 1.04, meaning that for every dollar invested in energy efficiency the benefits were $1.04; when benefits and costs from codes and standards activities are included this ratio is 1.31. Lighting programs delivered through financial

11 A total of $125 million was allocated for evaluation activities in the CPUC's 2010-2012 energy efficiency portfolio decision (D.09-09-047); this amount represents four percent of the program portfolio budget; further detail and processes governing the evaluation were adopted by the Commission in D.10-04-029.

12 The policy rules require that the energy efficiency portfolio as a whole has more benefits than costs, based on both the Total Resource Cost (TRC) and Program Administrator Cost (PAC) tests. The Standard Practice Manual details the Commissions' methodologies. Information at http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Cost-effectiveness.htm

incentives to the lighting distributors continue to be highly cost-effective, as are various programs that target very specific markets (like schools) and/or offer full-service assessment and installation (known as "direct install") for the customer. Appendix C provides the cost-effectiveness results for all programs. Not all individual programs are cost effective. The portfolio is intentionally designed and approved to balance cost effectiveness across sectors, activities, and measures to allow for innovation and prime the market to capture long term savings.

The utilities have also supported complementary programs that address long-term market transformation. For example, work force education and training, emerging technologies, and marketing education and outreach are intended to build capacity, identify technical opportunities, and inspire behavior change and awareness respectively. While the savings impact of these activities is not measured in the short term, these programs serve the important role of priming the market for future savings by building the state's capacity to deliver energy efficiency goods and services. The CPUC and the IOUs are continuing to support and develop market transformation activities throughout the portfolio.

Program Highlights

This report's chapters highlight thirteen broad areas of programmatic activity in the 2010-2012 energy efficiency portfolios that are designed to overcome barriers to investing in energy efficiency in a wide range of customer segments and promote a range of specialized technologies and services. Over the course of the three-year program cycle:

- The 2010-2012 statewide Codes and Standards Program budget costs just one percent ($30 million) of the total portfolio budget, but accounts for approximately 22 percent of the total electricity savings and 20 percent of the peak demand savings.
- Residential energy savings continue to be driven by long-running programs such as lighting and appliances, and significant savings have emerged from home energy reports, which present customers with information about their energy consumption compared to their neighbors as one method to prompt further efficiency actions.
- Commercial programs have been modified to standardize savings and expand participation in the audit, retro-commissioning, calculated incentives and direct install programs.
- Programs in the large commercial, industrial and agricultural sectors continue to deliver significant energy savings to California and are adapting to review processes prior to project implementation.
- The upstream HVAC equipment incentive program, in which distributors are incentivized to promote energy efficient products, has consistently been achieving savings goals and is cost-effective.
- More than 50 cities, counties, and regional governments are working with the IOUs as partners to deliver energy efficiency programs and services in their areas.
- In lighting, there are clear trends of falling shipments of basic lamps in IOU programs, and increasing trends for advanced lamps since 2008.
- On Bill Financing's $41.5 million loan pool was oversubscribed and generated more than 1,300 loans (50 percent of which occurred in the commercial sector) across the IOUs'

service territories, with a very low default rate of one-half of one percent – an indicator not only of popularity, but of success in driving adoption of energy efficient products and practices.

Challenges and Barriers to Success to Across the Portfolio

The evaluations for the 2010-2012 program cycle offer recommendations to help improve future programs. These recommendations are a key component of the evaluations cited throughout this report and are used by the IOUs and program implementers to improve program delivery and performance as soon as the evaluations are completed. The recommendations come from program impact evaluations, which primarily estimate energy savings from program efforts; process evaluations, which consider initial program design and expectations compared to actual implementation and outcomes; and market studies, which explore the workings of the larger markets in which these energy efficiency programs operate to identify potential gaps to be filled by properly implemented energy efficiency programs. A handful of additional studies focus on key market actors' behavior (e.g. retailers or contractors), the prevalence of energy efficiency measures in the market place (e.g. retail surveys), and the research underpinning key aspects of program design.

Recommendations from impact evaluations focus on estimating energy savings and how or why evaluated energy savings diverge from initial program savings assumptions. For instance, the Appliance Recycling Program impact evaluation found that an approximately thirty percent difference in reported versus evaluated savings was due primarily to recycled units being on average much younger than initially assumed and recommended a tighter focus on older units.

Process evaluations may recommend improved data collection, as it relates to program performance, as well as how and why to improve relationships with key program partners to ensure program delivery coincides with planning expectations. For example, the Workforce and Education Program process evaluation recommended targeted initiatives to support and improve K-12 and community college energy efficiency curriculum, as well as broader engagement by the IOUs in developing workforce sector strategies.

Recommendations from market studies may highlight how future program design can address market trends and dynamics, as well as how programmatic efforts have helped to shape and transform a market (i.e. "improve efficiency") to date and which opportunities remain. For example, the California Residential Replacement Lamp Market Status Report describes the higher cost of LED replacement lamps, as compared to CFL's, noting that this price differential must be addressed in order to facilitate increased sales of LED bulbs. Recommendations from studies that address key market actors' behavior may focus on how to improve training opportunities for contractors in order to improve program delivery, or which motivations program participants are more likely to respond to in the future. For instance, an HVAC contractor and technician behavior study explored contractor presented recommendations for each market actor group in order to address and overcome barriers presented by current contractor business models.

Sources of Energy Savings

The energy efficiency portfolio savings have been achieved via efficiency programs that target four market sectors. These programs promote improvements in efficiency by addressing barriers to the adoption of high efficiency technologies and other efficiency measures across the state, starting with research into new technologies, driving adoption in the market, and advocating and facilitating the adoption of codes and standards.

By Utility

Each of the four investor-owned utilities develops and executes a portfolio of energy efficiency programs and activities. The savings accrue to their customers, and are an opportunity to offset future procurement in their service territories.

Table 2. Distribution of Gross Evaluated Savings by Utility Service Territory (excluding Codes and Standards)

	GWh	MW	Therms (millions)
PGE	3,402	575	43
SCE	3,987	676	0
SCG	0	0	110
SDGE	647	106	6
Portfolio	8,037	1,357	160

By Sector

The residential, commercial, industrial and agricultural sectors are the four primary customer segments in the state. Ninety percent of portfolio electric savings achieved in the 2010-2012 program cycle occurred in the commercial and residential sectors (35% and 55%, respectively), with the agricultural and industrial sectors combined making up the remaining ten percent of electric savings. The industrial/agricultural and commercial sectors drive the majority of natural gas savings, representing 61 percent and 38 percent of total portfolio therm savings, which are diminished based on interactive effects from lighting that create "negative" therm savings in the lighting and residential sectors.[13] In designing the portfolio, the utilities consider the savings potential of each sector and design programs to capture savings for these given customer segments. In addition to these customer-specific interventions, programs oriented to codes and standards promotion represent approximately 22 percent of total portfolio savings when all segments are combined.[14] Codes and standards programs and savings are described in a dedicated chapter of this report.

13 Total therm savings from the portfolio are affected by "negative" savings in the residential and lighting sectors attributable to interactive effects related to lighting measures. Replacement of incandescent lighting with CFL's decreases waste heat and leads to greater therm usage to heat the occupied space. Evaluated net therm savings are just over 67 million therms. The industrial/ag sector realized evaluated net therm savings of nearly 68 million therms, while the commercial sector evaluated net therm savings were 26.5 million therms. However, the residential and lighting sectors had negative therm savings of 28 million and 58.5 million therms, respectively..

14 Codes and Standards projections, as currently estimated (2,178 GWh, 364 MW, and 30 MMtherms) are for the three year program cycle, and when compared to reported net savings they make up 33 percent of GWh, 30 percent of MW and 40 percent of therm claims to date.

Table 3. Distribution of Evaluated savings by customer sector (excluding codes and standards)

	Gross GWh	%	Gross GW	%	Gross Therms (millions)	%
Agriculture	262	3%	61	5%	7	4%
Commercial	2,783	36%	489	37%	60	35%
Industrial	559	7%	78	6%	97	57%
Residential	4,148	53%	679	52%	98	4%
	7,745	100%	1,308	100%	173	100%

By Technology

The technologies that drive savings vary by customer segment or sector; however, some technologies, such as high efficiency lighting or heating ventilation and air conditioning (HVAC), are prevalent in programs across the portfolio. For the 2010-2012 program cycle, the majority of evaluated electric savings come from lighting (64 percent, up from 58 percent for the 2006-2008 program cycle), followed by HVAC (8 percent) and process improvements[15] (9 percent). Natural gas savings are primarily achieved in the industrial sector, in which 92 percent of savings are generated through process improvements. Indoor lighting does offset therm savings portfolio wide by increasing heating load as a consequence of high efficiency lighting that generates less waste heat and thus requires more active heating. Likewise cooling load (typically electric) is decreased significantly due to reduced secondary heat that would be generated from inefficient lighting. Table 4 provides a summary of the technologies that make up the majority of the portfolio savings (Appendix B provides a detailed list of the specific technologies that make up the majority of reported savings in each sector).

15 A process improvement generally describes improved management of existing systems, modification or replacement of equipment, minimization of waste or resource usage, enhanced quality management, adoption of preventive maintenance and improvement of productivity and management practices.

Table 4. End Use or Technology making up majority of savings

	GWh	GW	Therms
Appliance	2.9%	3.8%	4.3%
Food Service	0.2%	0.2%	1.1%
HVAC	8.7%	14.6%	17.9%
Indoor Lighting	63.2%	60.0%	-20.7%
Other	0.7%	0.5%	7.9%
Outdoor Lighting	2.5%	0.3%	0.0%
Plug Loads	4.3%	2.6%	-1.3%
Process	9.1%	8.4%	65.5%
Refrigeration	5.2%	3.4%	0.3%
Water Heating	0.0%	0.1%	12.9%
Whole Building	3.2%	6.1%	12.1%
	100%	100%	100%

By Geography

The location of the savings achieved and the investments of energy efficiency are important for understanding how this resource may affect power supply and the relative effect on customers in various parts of the state. Maps provided in this section show the magnitude of electric and gas savings throughout the state by zip code and IOU. As shown in Figure 1, nearly half of electric savings occur in urban areas. Information about program participants and how and where the savings occur are captured in the tracking data supplied by the IOUs. CPUC staff provides detailed geographic information on savings

to supply-side planners (at the California Energy Commission and in the CPUC's Resource Adequacy and Long Term Procurement Planning proceedings) to understand more clearly where the savings occur and inform future energy grid planning. Models utilizing this detailed information are being developed to support future geographic targeting of programs. Readers can also explore the interactive maps for the 2010-2012 evaluated data on the CPUC's Energy Efficiency Stats web page (http://www.eestats.cpuc.ca.gov) to see geographic distribution of savings and expenditures and technologies supported by the IOU programs.

Figure 1. Net Evaluated Electricity Savings (GWh) 2010-2012

Organization of this Report

The report is organized into the following sections:

Residential	Commercial
Industrial and Agriculture	Heating, Ventilation and Air Conditioning
Codes and Standards	New Construction/Zero Net Energy Buildings
Integrated Demand Side Management	Workforce Education and Training
Marketing, Education and Outreach,	Emerging Technologies
Government Partnerships	Lighting
Financing	Energy Efficiency Potential and Goals

The inclusion of cross-cutting chapters, including lighting and HVAC, prevents the sector-based savings presented in each chapter from being additive (i.e. lighting and HVAC programs are addressed in separate chapters, although the savings impacts from these end uses are included in other sectors to show the contribution to savings in each sector).

The appendix to this report provides the detailed summaries of accomplishments by utility, program, sector, and measure group. Cost effectiveness and emissions information are also provided. A description of the data backing up the report and links to the actual data are also provided in the on-line appendix. This also includes a summary of the incremental effects of each parameter update based on field evaluations conducted this cycle.

Residential

Overview

With 13.7 million single- and multi-family homes that house more than 38 million Californians, the residential sector accounts for approximately one third of the state's electric and gas usage.[17] To address the needs and opportunities for savings in this sector, the 2010-2012 portfolio included a comprehensive suite of traditional activities (e.g., appliance rebates) for California households. However, with an eye towards advancing the Strategic Plan's goals of moving from "widget"-based to more comprehensive approaches, the portfolio also introduced new programs to support a "whole house" approach to achieve deeper energy savings per dwelling (starting with an investment-grade audit, followed by integrated retrofits).

Estimated Savings

At the end of the 2010-2012 program cycle, the IOUs spent approximately $653 million (8 percent of total portfolio expenditures) on residential efficiency programs, resulting in evaluated savings of 4,271 GWh and 688 MW, representing approximately 55 percent and 52 percent of total portfolio gross electric savings and demand savings, respectively. Approximately two-thirds of both the gross electric and demand savings were directly attributable to program interventions.

17 See 2010 Census State and County Quick Facts, accessed July 12, 2013, http://quickfacts.census.gov/qfd/states/06000.html and California Long-term Energy Efficiency Strategic Plan, Section 2, page 9, available at http://www.cpuc.ca.gov/NR/rdonlyres/A54B59C2-D571-440D-9477-3363726F573A/0/CAEnergyEfficiencyStrategicPlan_Jan2011.pdf.

Table 5. Residential Sector IOU-Reported Savings and Budget Snapshot

		Expenditures	Energy Savings			Emissions	Cost Effectiveness
		Million ($)	Electric (GWh)	Demand (MW)	Natural Gas (MM Therms)	CO_2 (Tons)	TRC
Reported	Gross	653	4,183	685	4	2,360	2.06
	Net		2,809	464	7	1,611	1.64
Evaluated	Gross		4,271	688	7	2,419	2.19
	Net		2,832	459	9	1,627	1.70

Program activity in the residential sector is diverse. The majority of evaluated residential sector savings for the 2010-2012 program cycle come from lighting, appliance recycling, household appliances, and consumer electronics, respectively.[18] Approximately 84 percent of evaluated savings and 34 percent of expenditures in the residential sector are attributable to lighting measures. Approximately one percent of evaluated electric savings come from HVAC measures. The Lighting and HVAC programs are addressed in separate chapters, although the savings impacts from these end uses are included in the residential sector-focused chapter to show the contribution to savings in this sector.

The Multifamily Energy Efficiency Rebate (MFEER) program directed at multifamily property managers and operators makes up approximately two percent of evaluated residential sector electric savings, but tenants in multifamily complexes (which account for 31 percent of California residents) may have purchased lower-priced energy efficient products and benefitted from an unknown amount of upstream rebates.[19] Nearly 90 percent of IOU-reported multifamily electric (GWh) savings come from lighting, but the trend in total program energy savings from lighting has decreased. Newer pilot programs that are focused on market transformation and longer-term reductions—such as the Advanced Home Upgrade and Home Upgrade Program[20]—do not currently make up a significant portion of the budget or total energy savings in this sector. Appendix E provides savings claims for each residential sector program. Although individual programs in the residential sector may not be cost effective (as shown in Appendix D) the Commission requires the IOUs to design and implement their portfolios to be cost effective on a combined basis and recognizes that individual programs may not be cost-effective, especially in their nascent stages or after significant re-design.

Residential Energy Efficiency Programs

The 2010-2012 statewide programs were designed to achieve energy savings through the adoption of energy efficient products, whole house retrofits and behavior change using rebates, incentives, contractor

18 Basic CFL, Advanced Consumer Lighting, the Appliance Recycling Program, the Business and Consumer Electronics Program, and the Home Energy Efficiency Rebates Program are, respectively, the top 5 programs by reported savings.

19 See 2010 Census State and County quick facts, accessed July 12, 2013, http://quickfacts.census.gov/qfd/states/06000.html .

20 Energy Upgrade California program information site, accessed July 12, 2013, https://energyupgradeca.org/overview

training and education. The Home Energy Efficiency Rebate (HEER) program, which offers rebates for high efficiency residential appliances, water heaters, pool pumps, insulation and other high efficiency technologies to single-family home owners, is the largest residential program (based on expenditures).[21] Other residential programs include Basic CFL Incentive and Advance Consumer Lighting; the Appliance Recycling Program (ARP); the Business Consumer Electronics (BCE) program that focuses on consumer electronics plug loads;[22] the Home Energy Efficiency Survey (HEES), Home Energy Guide, and Universal Audit Tool (UAT) that provide customers with energy saving tips and information on overcoming market barriers; the HVAC Quality Installation and Quality Maintenance program, which improves the efficiency of heating and cooling systems; Home Energy Reports (HER), behavior-focused comparative usage programs that encourage participants to reduce energy consumption through no-cost energy conservation actions and self-installation of low-cost energy savings measures; and the Energy Upgrade California Advanced Home Upgrade and Home Upgrade Program. [23] Residential programs that target the hard-to-reach multifamily segment include the Multifamily Energy Efficiency Rebate and Middle-Income Direct Install programs.[24] Appendix E provides a complete list of residential sector programs.[25]

Highlights

The residential programs are responsible for approximately 55 percent of total evaluated portfolio energy savings[26] and the broad swath of programs listed above have reached out to hundreds of thousands of Californians to spur them to take action to improve efficiency.

One significant outreach program new to the 2010-2012 period is PG&E's Home Energy Reports (HER) pilot which delivered print reports to approximately 650,000 residential customers. These reports provided detailed comparative energy usage information to customers and, based on a randomized control trial, the PG&E program estimated the program delivered net energy savings of 50 GWH and natural gas savings of 1.5 million therms.[27] SDG&E had a smaller, similar pilot that delivered net energy savings of 5 GWh and 218,000 therms.[28] PG&E's Home Energy

21 Lighting programs are the largest residential programs, but they are presented in a separate chapter. The HEER program is the largest by budget, while the Appliance Recycling (ARP), HEER and Business and Consumer Electronics programs are the three largest, respectively, by evaluated energy savings.

22 Plug load devices include televisions, set-top boxes, DVD players, music systems, computers, doorbells, alarm systems, toasters, coffee makers, hair dryers, garage door openers, and rechargeable tools.

23 See "Program Guidance for the Residential Sector" pp. 161-214, in Decision D.12-05-015 at http://docs.cpuc.ca.gov/WORD_PDF/FINAL_DECISION/166830.PDF. Plug load, appliances and "miscellaneous" uses comprise about 66 percent of current California home electricity usage, with plug loads accounting for about 20 percent of home electricity usage alone. Program guidance for behavior programs may be found in CPUC Decision 10-04-029, available at http://www.calmac.org/events/D1004029.pdf .

24 The multifamily segment is considered "hard-to-reach" for a number of reasons, including a higher-percentage of low-income residents and the split-incentive issue, in which residents don't own their property or appliances and owners don't reap the energy savings from installed efficiency measures.

25 Detailed program implementation plans and program fact sheets can be found on the Energy Division website: http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Statewide+Programs.htm

26 Based on Energy Division-reviewed IOU program tracking data, available at www.eestats.cpuc.ca.gov .

27 See Evaluation of Pacific Gas and Electric Company's Home Energy Report Initiative for the 2010-2012 Program, April 2013, at http://www.calmac.org/publications/2012_PGE_OPOWER_Home_Energy_Reports__4-25-2013_CALMAC_ID_PGE0329.01.pdf

28 See SDG&E Home Energy Reports – Final Savings Results, September 2013, at www.calmac.org .

Report was the third-largest electricity saver in the IOUs' residential portfolio.

Findings

Evaluation studies completed for the 2010-2012 program cycle provide valuable insights about residential program activity. Final evaluations on several residential program offerings, including appliance recycling, whole house strategies, home energy efficiency surveys, home energy reports, and incentives for energy efficient televisions, as well as program data on rebates, have identified some significant challenges.

- An impact evaluation determined that the Home Energy Efficiency Survey customer audit program, which requires participants to complete a home energy usage survey and delivers survey-based energy savings recommendations, delivered average annual bill savings of 2-3 percent, depending on delivery method. Onsite audits resulted in the highest electric savings-per-participant, with online surveys producing the majority of electric savings but the lowest electric savings-per-participant. Lighting and hot water measures were the high-energy savers, likely attributable to their low-cost and ease of installation.[29]
- Home Energy Efficiency Survey program participants implemented approximately 11 percent of all recommended practices (i.e. participant alterations in energy usage habits and routines) but only 7 percent of technology upgrades recommendations.[30] The highest implementation rates statewide were for efficient refrigerator and freezer practices (19 percent) and efficient water heater practices (18 percent), while the lowest implementation rates were for efficient cooling and lighting practices (~8 percent).
- PG&E's HER initiative resulted in an average savings of approximately 1.5 percent of household electricity use and approximately 1.0 percent of household natural gas use. SDG&E had a similar, smaller-scale pilot that achieved similar levels of savings. [31]
- The BCE program provided approximately 90 percent of incentives to televisions. The evaluation found that many of the high efficiency televisions would have been purchased regardless of the program; CPUC staff and the IOUs acknowledge there were many factors at play in this market for the 2010-2012 program. [32]
- Evaluated savings from the Appliance Recycling program were 30 percent lower

29 See 2010-2012 CPUC HEES Impact Evaluation, July 2013, at http://calmac.org/publications/HEES%5FFinal%5FReport%5F20130708%2Epdf

30 ibid.

31 See Evaluation of Pacific Gas and Electric Company's Home Energy Report Initiative for the 2010-2012 Program, April 2013, at http://www.calmac.org/publications/2012_PGE_OPOWER_Home_Energy_Reports__4-25-2013_CALMAC_ID_PGE0329.01.pdf

32 See Program/Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER)/Business & Consumer Electronics (BCE), September 2012, at http://calmac.org/publications/HEER%5F%5FBCE%5F083012%5FFINAL%2Epdf ; see Impact Evaluation Report – Business and Consumer Electronics Program (WO34), April 2013, at http://calmac.org/publications/WO34%5FBCE%5FImpact%5FEvaluation%5FReport%5F%2D%5FPhase%5F1%5FFINAL%5F2013%2D04%2D15%2Epdf. (The BCE Impact Evaluation used a Delphi Panel to estimate free-ridership levels. This approach was not without controversy and resulted in a wide range of initial free-ridership estimates based on certain aspects of program delivery and composition of the Delphi Panel. Energy Division's final estimate of .223 is to be used with caution, but reveals that 78 percent of program activity would have happened in the absence of the program.); Also see Commission Decision D.12-05-015, p. 205, at http://docs.cpuc.ca.gov/WORD_PDF/FINAL_DECISION/166830.PDF .

than reported savings, as the average unit energy consumption for primary and secondary refrigerators in 2012 had decreased by 15 percent and 20 percent, respectively, since 2005 (CLASS). Additionally, evaluated savings were lower due to incorrect baseline assumptions.

- The 2012 California Lighting and Appliance Saturation Survey (CLASS) revealed that across the IOU service territories, 70 percent or more of primary and secondary refrigerators are less than 12 years old, meaning a majority of units "on the grid" are highly efficient and future savings opportunities via legacy refrigerator programs (both sales of new units and recycling) will continue to diminish.[33]
- The Home Energy Efficiency Rebate program suffers from high free-ridership; program participants who purchase certain measures take advantage of an incentive though they likely would have taken the action without the rebate.
- By the end of 2012, the Whole House program had reached approximately 6,300 homes, which is lower than the program goals. The program has been challenged by the housing crisis, limited financing options, high up-front homeowner expenses, and ensuring sufficient contractor skills. Additional concerns related to the energy simulation tool used to estimate usage and potential savings, geographic-based savings potential, as well as the incidence of free-ridership, are shaping continued guidance by the IOUs and CPUC staff to re-orient ongoing single family program development and implementation and a new multifamily program effort. [34]
- The Multifamily Energy Efficiency Rebate program has made some changes to capture non-lighting opportunities. While performance across utilities varies, more than 90 percent of statewide electric savings for multifamily buildings for the 2010-2012 program cycle were derived from lighting, most likely attributable to continued ease of installation and low-cost.
- Energy savings from lighting as a percentage of total program energy savings (in BTUs as defined in the program performance metric for the Multifamily Energy Efficiency Rebate program) has dropped from 76 percent in 2006-2008 to 45 percent in 2010- 2012.[35]

Recommendations

Evaluation studies for the 2010-2012 program cycle completed to date and findings summarized above provide the following recommendations for improving future residential programs:

- Increase customization of energy efficiency measure and practice recommendations to participants in residential programs such as

33 See D. 11-07-030, Appendix A-B, page A-11 at http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/139858.PDF

34 See SCE and PG&E Whole House Process Evaluation, SBW, May 2012, at http://www.energydataweb.com/spuc/search.aspx.

35 See ED-reviewed IOU program tracking data, which includes program performance metrics for the 2010-2012 program cycle; and 2010-2012 PG&E and SCE Multifamily Energy Efficiency Rebate Program (MFEER) Process Evaluation and Market Characterization Study, April 2013, at http://calmac.org/publications/MFEER%5FProcess%5FEvaluation%5FFINAL%5F130415%2Epdf . Commission directive for the MFEER program is found in Commission Resolution E-4385 at http://docs.cpuc.ca.gov/word_pdf/FINAL_RESOLUTION/127632.pdf .

HEER, HEES, and Energy Advisor (all of which are under the "Plug Load and Appliance" umbrella program for 2013-2014), including information on estimated payback period associated with energy efficiency upgrades, in order to improve uptake.[36]

- Maintain alternative communication channels such as telephone and mail-in options to ensure HEES availability for all customers. As the IOUs transition towards the web-based Universal Audit Tool and a larger on-line presence to drive energy efficiency savings, they must maintain contact with customers who may not yet embrace this approach, as telephone and mail-in participants used as much or more energy than online participants.[37]
- Provide financial and technical guidance within the Whole House program in support of CALTEST to improve predicted consumption. Additionally, Whole House program incentives design should be revised to a per-unit of energy saved basis, and the program should be refocused to inland areas with warmer temperatures.
- The Business and Consumer Electronics and Home Energy Efficiency Rebate programs need a holistic, flexible program model that works towards market transformation and is able to quickly change intervention strategies. Incentives should be better targeted to address specific adoption barriers, to reduce free-ridership.[38]
- The Appliance Recycling Program should improve data collection efforts, to ensure that younger units with lower unit energy consumption (2001 or newer) are not included in the program. Additionally, the ARP, in concert with the HEER, should explore the use of SmartMeter data to realign program efforts and improve targeting of high-usage units.
- Maintain and improve alignment of residential program (Home Energy Efficiency Rebate, Business and Consumer Electronics, Multifamily Energy Efficiency Rebate, and EUC) training for retailers and contractors in order to address gaps in effective program performance and required skill sets.[39]
- Ensure contractors and property owners are aware of the full range of MFEER program opportunities through targeted marketing and outreach.

For More Information

Findings from evaluation results included in this chapter and studies related to several residential programs and six residential market studies may be found at www.calmac.org and www.energydataweb.com/cpuc/.

Completed Studies:

- Evaluation of PG&E's Home Energy Reports (OPOWER) Pilot Programs

36 See 2010-2012 CPUC HEES Impact Evaluation, July 2013, at http://calmac.org/publications/HEES%5FFinal%5FReport%5F20130708%2Epdf

37 See 2010-2012 CPUC HEES Impact Evaluation, July 2013, at http://calmac.org/publications/HEES%5FFinal%5FReport%5F20130708%2Epdf

38 See Program and Technology Review of Two Residential Programs: Home Energy Efficiency Rebate (HEER)/Business and Consumer Electronics (BCE), September 2012, at http://calmac.org/publications/HEER%5F%5FBCE%5F083012%5FFINAL%2Epdf

39 See Program/Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER)/Business & Consumer Electronics (BCE), September 2012, at http://calmac.org/publications/HEER%5F%5FBCE%5F083012%5FFINAL%2Epdf ; and See SCE and PG&E Whole House Process Evaluation, Opinion Dynamics and SBW, May 2012, at http://www.energydataweb.com/cpuc/search.aspx .

- Business and Consumer Electronics Impact Evaluation
- SCE/PGE Home Energy Efficiency Rebates Program/Business and Consumer Electronics Process Evaluation & Market Characterization Study (Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business and Consumer Electronics (BCE)
- PG&E/SCE Whole House Rebate Program Process Evaluation
- PG&E/SCE Multifamily Energy Efficiency Rebate Program Process Evaluation and Market Study
- PG&E/SCE Mobile/Manufactured Home Program Process Evaluation Study
- SCE Appliance Recycling Program Retailer Trial
- SCE Multifamily Audit Tool Technology Assessment
- SCE/PG&E Appliance Recycling Process Evaluation and Market Characterization
- PG&E Whole House Rebate Program Process Evaluation Phase II
- Residential On-Site/Metering Survey
- Residential Market Share Tracking
- Residential/Advanced/Upstream Lighting Impact Evaluation
- Residential Appliance Recycle Refrigerator and Freezer Impact Evaluation
- Residential Whole Building – Retrofit Impact Evaluation

Commercial

Overview

The commercial sector represents over 5 billion square feet of highly diverse space—not only office buildings but also food and retail stores, hotels, restaurants, warehouses, schools, hospitals, public buildings and data centers.[40] Commercial buildings consume more electricity than any other sector in California constituting 38 percent of the state's power use and over 25 percent of natural gas consumption.[41] Given the large portion of energy use that comes from this sector, commercial buildings are the focus of several state policies focused on substantially reducing building energy usage and will likely compliment the continued efforts of the IOUs in this sector. Significant improvements in commercial building energy efficiency are expected through programs managed by the California Energy Commission, which include the implementation of AB 1103 (Saldana, 2007)[42], Nonresidential Building Energy Use Disclosure program (benchmarking) and AB 758 (Skinner, 2009), Comprehensive Energy Efficiency Program for Existing Buildings. The upcoming release of the California Energy Commission (CEC) AB 758 Action

40 See Appendix E for a list of programs that are categorized as commercial for this chapter; institutional partnerships are included in the commercial savings. For Appendix E support data in .xls format, go to http://eestats.cpuc.ca.gov/Views/AnnualReport/AnnualReport.aspx?ContentId=15.

41 CPUC Strategic Plan Progress Report, October 2011, http://www.cpuc.ca.gov/NR/rdonlyres/5D0472D1-0D21-46D5-8A00-B223B8C70340/0/StrategicPlanProgressReportOct2011.pdf.

42 AB 1103 requires disclosure at the time of sale and lease of a nonresidential building energy use score from Energy Star Portfolio Manager for the buildings previous 12 months of customer usage data. Statewide Benchmarking Process Evaluation completed April 2013.

Plan will continue to create momentum by identifying priorities for commercial building upgrade programs. Recent legislation supporting energy efficiency retrofits in schools (Proposition 39) will also influence this market, but was not in effect during the 2010-2012 program cycle covered in this report.

Estimated Savings

At the end of the 2010-2012 program cycle, the IOUs spent approximately $970 million (38.5 percent of total portfolio expenditures) on commercial energy efficiency programs. Evaluated gross savings were 2,312 GWh and 395 MW representing 29 percent of total portfolio gross electric and demand savings. About 60 percent of the electric, 64 percent of demand, and half the natural gas savings were directly attributable to the program interventions.

Across the three electric IOUs, 11 to 17 percent of commercial businesses participated in at least one IOU energy efficiency program during the 2010-2012 program cycle.[43] Business segments with the highest share of participation include food and liquor stores, hotels, and schools. Businesses with the lowest share of participation include offices, warehouses, and non-hospital health care.[44] In addition, a larger share of businesses with higher electricity consumption participated in IOU energy efficiency programs than businesses with smaller electricity consumption.

43 Table 3.7 in the Commercial Saturation Survey and Market Share Tracking Telephone Survey Findings, Itron, Inc., September 2014.

44 Table 3.5 in the Commercial Saturation Survey and Market Share Tracking Telephone Survey Findings, Itron, Inc., September 2014.

Table 6. Commercial Sector Savings and Budget Summary

			Energy Savings				
		Expenditures (Million $)	Electric (GWh)	Demand (MW)	Natural Gas (MMTherms)	CO_2 Emissions (Tons)	Cost Effectiveness TRC
Reported	Gross	970	3,312	641	41	2,143	1.90
	Net		2,433	475	25	1,543	1.45
Evaluated	Gross		2,311	395	46	1,577	1.39
	Net		1,410	240	23	931	0.87

Roughly half of the evaluated electric savings in the commercial sector come from lighting measures, and about 17 percent from HVAC. For natural gas savings, HVAC makes up about 21 percent of evaluated savings in the sector. The lighting and HVAC program impacts are included in a separate chapter, and the savings impacts from these end uses are included in this commercial sector-focused chapter to show the contribution to savings in this sector.

Field evaluations estimated that approximately 72 percent of the IOU-reported electric claims were realized. Natural gas savings for the sector were higher than reported, due to lower savings realized through lighting interventions and therefore lower negative therm impacts. The savings directly attributable to the program interventions were initially assumed to be about 70 percent, and after field evaluation (including interviews with customers and review of practices in the market), direct influence was determined to be closer to 60 percent. The programs were not cost-effective, with a TRC of 0.87 when the direct influence of the program is taken into account. A number of factors contributed to evaluated net savings having a cost effectiveness less than 1and can be further explored in the appendix data.

Commercial Energy Efficiency Programs

California's 2010-2012 energy efficiency portfolio includes 107 programs and sub programs that target a wide range of large, medium, and small commercial customers.[45] The programs reach commercial customers through standard rebate programs with a pre-set menu of measures and incentives; direct install programs that provide low- or no-cost assessments and installation services; customized projects for large commercial customers; and new construction design assistance. IOUs offer the Energy Advisor Program, which provides the continuous energy improvement, benchmarking, online audit, and other offerings to assist customers with implementation of appropriate energy efficiency solutions. Programs are focused on specific target markets, due to the variety of commercial building types and functions, including: distribution warehouses, office buildings, hotels, motels, restaurants, schools, universities, colleges, hospitals, high-tech facilities, bio-tech facilities, retail facilities, entertainment centers, and smaller

45 Institutional partnerships with the Department of Corrections and the University of California have been included in this sector.

commercial customers.[46] Energy efficiency vendors and contractors are the key delivery channels for the programs working with manufactures and retailers to reach customers and identify savings. Internally, the IOUs coordinate amongst their business divisions to ensure an integrated delivery of products and services to businesses. The primary technologies that are supported by commercial sector programs are indoor lighting, HVAC, whole building, refrigeration, building envelope, and plug loads. Commercial "core deemed programs" serve all business customers, and third-party programs and institutional partnerships offer more targeted, specialized program offerings.

Highlights

Over the course of program implementation in 2010-2012, the commercial programs experienced some modifications to standardize savings and expand participation. For example, for the Non-Residential Audit program, SoCalGas reported expansion of retro-commissioning (RCx) efforts to standardize energy savings calculations for high impact measures, and SCE created and rolled out the Statewide RCx Policy Manual. The IOU calculated incentives programs introduced integrated solutions such as iBonus for applications with measures including Automatic Demand Response. The Direct Install program expanded marketing and collaboration amongst various internal and external stakeholders to stimulate greater participation, including a district approach to serve customers. A district approach targets one geographic area to insure that the marketing is aligned with the customer demand generated by the marketing effort. Continuous Energy Improvement (CEI) program was piloted to test approaches in supporting improved energy management practices within business and building operating plans. During the 2010-2012 cycle, a large scale survey of over 7000 customers in the commercial sector was completed. The Commercial Market Share Tracking Study and the Commercial Saturation Survey research projects coordinated to collect the data necessary to describe current baseline saturation of measures and current baseline purchases of select high priority equipment.

Findings

The key findings listed below include results from evaluations completed for 2010- 2012 activities. There are four primary commercial programs that were assessed by the studies. The performance and delivery of these programs have statewide similarities and all programs create and support energy saving projects. Many of the key findings among the IOU Core Deemed Programs, Third-Party Programs, and Statewide Institutional Partnerships are summarized in this section including findings from the Commercial Market Share Tracking and Commercial Saturation Study.

The Program Assessments Study: Core Deemed Programs[47] assessed the performance of a large portion of the state's commercial portfolio of programs. The deemed programs are currently delivered in fairly homogeneous fashion across all of the investor-owned utilities and offer measures that have a prescriptive savings estimate "deemed". Because of the significant similarities in program design and

46 IOU Annual Reports, filed May 1, 2012 at www.eestats,cpuc.ca.gov

47 Nonresidential Program Assessments, Core Calculated Program Group Report and Program Assessments Study: Core Deemed Programs, February 2013 http://www.energydataweb.com/cpucFiles/pdaDocs/963/Non%20Res%20Core%20Calculated%20Prog%20Assess.pdf

delivery they can be described as a group. Key findings from this report include the following:

- The deemed program has potential to address new priorities in the future, but planning is needed to navigate the difficult challenge of addressing a new set of market barriers.
- Deemed programs employ a market "push" strategy and this combined with creating working relationships with trade allies are important to program success.

The Third-Party Programs have forty-nine commercial resource programs statewide.[48] Third-Party Programs are successful in sectors that the IOUs have struggled to reach or to create comprehensive energy savings projects. The programs provide a higher level of service to their customers through the programs. Here are some key findings from the Third-Party assessment report:

- Despite policy objectives encouraging deep, long-term energy savings, many commercial efficiency projects continue to focus on short-term payback and savings that may incent large projects, heavily emphasizing lighting, but not necessarily deeper savings from more comprehensive interventions.
- Competition amongst third parties for energy efficiency services can lead to customer confusion, but does allow customers multiple options with an elevated quality of service.
- While Third-Party Program implementers may have both the skills and the interest to maximize demand response participation while delivering energy efficiency, current third-party compensation terms are not enough to motivate cross-promotion of programs.
- Incentives for new technologies, especially those with a longer payback, are currently too low to help offset the resistance of program implementers in the commercial sector to promote new technologies.

Statewide institutional partnerships[49] programs that focus on state-owned-buildings represent another subset of commercial buildings that have the potential to transform the market but are currently limited to retrofitting and retro-commissioning existing facilities. This sector is described more fully in the Government Partnership chapter. The Statewide Institutional Partners include:

- California State University (CSU)
- California Community College (CCC)
- California Department of Corrections and Rehabilitation (CDCR)
- University of California (UC)
- State of California Partnership (SOC)

The CSU/UC, CCC, and CDCR partnerships are continuing to develop longer term sustainability plans and strategies, and they are refining a continuous improvement approach to energy efficiency. The State of California Partnership is responsible for delivering deep and sustainable energy efficiency savings across more than 30 state government agencies. The State of California Partnership, however, has no line of authority to drive energy efficiency within the agencies it serves and there is no clear connection

48 California Nonresidential Program Assessments Study, Third-Party Commercial Resource Program Group Report, (2010-2012) http://www.calmac.org/publications/3P_Commercial_PA_Report_Final_revised_toED.pdf

49 The Chapter on Government Partnerships has information about Statewide Institutional Partnership.

between the goals of the SOC partnership and the energy savings directives from the Governor's office. Partnerships have expressed concerns about their ability to carry over incentive funds for multi-cycle projects even though rules have been developed to facilitate long-term committed projects.

Nonresidential Audit and Pump Test Programs are operated as a mix of resources and non-resource subprograms to the sectors with consistent overall design throughout the state. However the implementation and management of the individual program components and specifically the tools they use for the audits vary. These programs feed other programs and policies, which means that the program offers benefits beyond their own direct saving. One primary benefit of these programs is that they gather a large quantity of important data about customer facilities and opportunities to inform follow up action by the IOU.

- A key element to success of the program is the utility account representatives who screen customers to match their needs to the various audit offerings or refer them to another program.
- PG&E has found that since combining the demand response and energy efficiency audit in 2007, Demand Response has had approximately ten times more KW saving per dollar invested.[50]

The Commercial Market Share Tracking Study and the Commercial Saturation Survey research projects[51] analyzed the market for high priority measures using recent purchase information collected from both end users and supply-side actors. The Commercial Saturation Survey (CSS) study collected baseline information (equipment) about energy consuming measures at commercial buildings in California and describes the efficiency levels of electric consuming measures in the IOUs' territories.

- Eleven to seventeen percent of commercial sites participated in IOU energy efficiency programs between 2009 and 2012.
- Only 39 percent of linear lighting technologies installed in very small businesses were high efficiency.
- Eighty-one percent of HVAC equipment in CSS businesses were under 65 kBtuh and only 27% of these units are 13 SEER or higher (Standard Efficiency was 13 SEER during data collection).

The Commercial Market Share Tracking Study (CMST) collected information on the efficiency of commercial purchases for linear fluorescent lighting, televisions, and small packaged HVAC units in California.

- Seventy-two percent of small packaged single zoned HVAC units purchased from 2009-2012 have a SEER 13 efficiency rating, the least efficient rating available on the market.
- Approximately 50 percent of TV purchases for commercial sites were not ENERGY STAR certified.

50 See Program Assessment Study: Nonresidential Audit & Pump Test Programs, December 10, 2012 http://www.energydataweb.com/cpucFiles/pdaDocs/906/NRA%20Final%20Report.pdf

51 The Commercial Market Share Tracking Study describes the commercial recent purchase market for linear florescent lighting, televisions, and small packaged HVAC units in California. The Commercial Saturation Survey was designed to collect baseline information about energy consuming measures at commercial building in California.

- Slightly more than half of linear fixtures purchased from 2009 to 2012 by commercial customers are high efficiency units.
- Purchases of high performance and reduced wattage T8 commercial lighting have risen during 2009-2012 while 700 and 800 T8s purchases have declined.
- Forty-six percent of recently purchased linear lighting fixtures are Base Efficiency and 54 percent are high efficiency.

Recommendations

The recently completed studies shared in this section as well as in the lighting and HVAC chapters provide many recommendations for improvements across the commercial sector programs. A few of the recommendations are provided here.

- The Core Deemed IOU programs promote pre-defined measures, rather than custom solutions that employ a "market" push strategy that requires building strong relations with trade allies and a strategic market transformation plan. The IOUs should strengthen these critical relationships through more communication (e.g., through informational meetings, increased training, etc.).
- The State of California Institutional Partnerships should develop a sustained and structured approach to energy efficiency including the development of agency plans, tracking of performance, and top down involvement from each agency.
- The long-term nature of projects within the Institutional Partnership requires improvement in the communication and understanding of rules governing committed incentive carryover to ensure all long-term savings are achieved. Program planners are uncertain of program policy due to a short program cycle with long-term projects, which require long-term planning.
- Long-term projects that require funding beyond the three-year program cycle shall be specifically identified in the utility portfolio plans and shall include an estimate of the total costs broken down by year and associated energy savings.
- The IOUs should develop audit tools to allow cost-effective delivery of the audit information via the Core Nonresidential Audit & Pump Test Programs[52] to encourage greater integration of energy efficiency, demand response and distributed generation offerings. Alignment of the regulatory cycles for these strategies may be helpful, but other significant barriers will remain. The link between audits and energy efficiency action may be improved by tying account executive incentives to an audit conversion rate and restructuring third-party contract terms and conditions may encourage deep retrofits.[53]
- The Commercial Saturation Study found that small and very small businesses have a higher share of base efficiency lighting and HVAC than medium and larger businesses. Small and very small businesses also have a relatively lower incidence of energy efficiency program participation and self-reported knowledge of available programs. Opportunities in this market need more exploration.

52 Per decision D. 09-09-047, incorporation of IDSM opportunities into IOU audits is a CPUC policy objective that has not been attained, now four years after it was identified.
53 Nonresidential Program Assessments Study, Early Feedback Memorandums, May 2012

For More Information

Findings from studies related to commercial sector may be found at www.calmac.org and www.energydataweb.com/cpuc/. These completed studies are listed below:

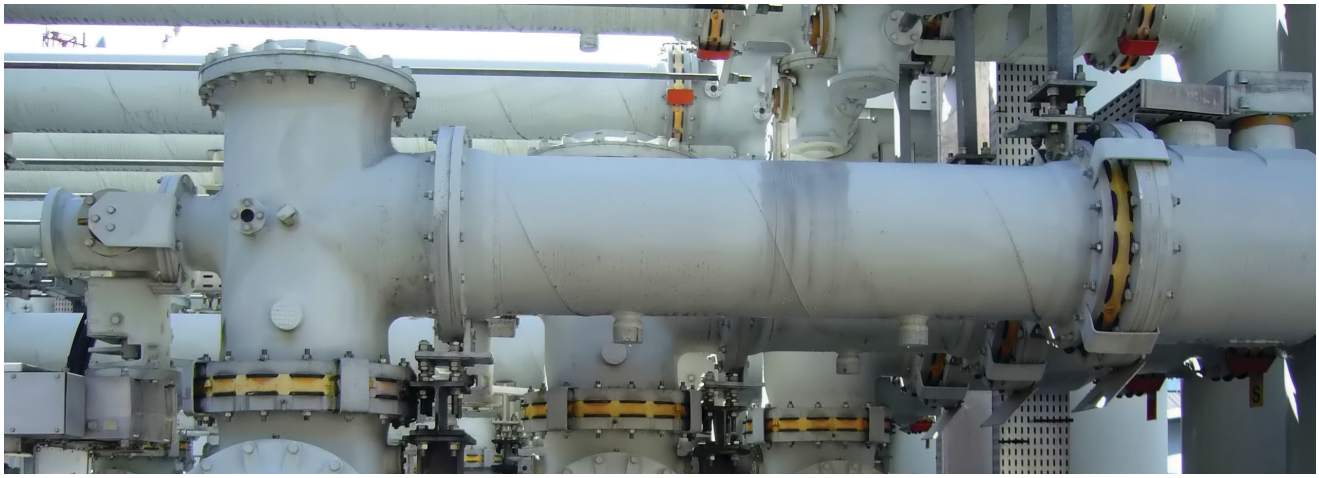
Completed Studies

- SDG&E Nonresidential Process Evaluation: Heschong Mahone Group; EMI; Evergreen Econ: Navigant Consulting, Inc; Research Into Action, Inc.; Tetra Tech, March 2012 http://www.calmac.org/publications/SDGE_NR_Process_Eval_Final_Report_-_Main_Report.pdf
- PY2010-2012 Nonresidential Program Assessments, Core Calculated Program and Group Report and Program Assessments Study: Core Deemed Programs: January 2013 http://www.energydataweb.com/cpucFiles/pdaDocs/963/Non%20Res%20Core%20Calculated%Prog%20ASSess.pdf/search.aspx
- SoCalGas Nonresidential Process Evaluation: Heschong Mahone Group: TetraTech, March 2012 http://www.calmac.org/publications/SCG_NR_Process_Eval_Final_Report_-_Main_Report.pdf
- Program Assessments Study: Statewide Institutional IOU Energy Efficiency Partnership Programs Navigant, October 2010 http://uccsu.northwoodsoft.com/Statewide_Institutional_IOU_Energy_Efficiency_Partnership_Assessment.pdf
- Third-Party Commercial-Resource Program Group Report: Heschong Mahone Group, August 2013 http://www.calmac.org/publications/3P_Commercial_PA_Report_Final_revised_toED.pdf
- SCE HVAC Quality Maintenance Program-Rapid Feedback Process Evaluation: Energy Market Innovations, January 2014 http://www.calmac.org/publications/EMI_SCE_Rapid_Feedback_CQM_Report_Final2_3_14.pdf
- SCE/PG&E Basic/Advanced LMT Program Process Evaluation: Commercial Lighting Retrofits: Evergreen Econ; D&R International; Research Into Action, Inc., October 2013 http://www.calmac.org/publications/SCE0307.01_SCE_and_PGandE_Lighting_Final_Report.pdf
- Statewide Benchmarking Process Evaluation: NMR Group, Inc.: Optimal Energy, Inc., April 2012 http://www.calmac.org/publications/Statewide_Benchmarking_Process_Evaluation_Report_CPU0055.pdf
- Impact Evaluability Assessment of California's Continuous Energy Improvement Pilot Program: CADMUS; October 2013 http://www.calmac.org/publications/CA_CEI_Pilot_Evaluability_Assessment REVISED FINAL.pdf
- Building Optimization Analysis (BOA) Tool Final Project Report to PG&E: PECI, September 2010 http://www.calmac.org/publications/BOA_Tool_Final_Report.pdf
- California LED Lamp Market Characterization - Development of a Lighting Solutions Workbook for the LMT Program: CADMUS,

January 2012
http://www.calmac.org/publications/LMT_Workbook_Final_Report_2-24-12.pdf

- Commercial Saturation Study, Itron, July 2014
http://www.energydataweb.com/cpuc/search.aspx
- Commercial Market Share Tracking Study, Itron , July 2014
http://www.energydataweb.com/cpuc/search.aspx
- Non-residential Audit and Test Pump Programs, January, 2013
http://www.energydataweb.com/cpucFiles/pdaDocs/906/NRA%20Final%20Report.pdf

Industrial and Agriculture



Overview

Two of California's biggest economic contributors are also two of California's biggest energy consumers, with the industrial and agriculture sectors accounting for approximately 22 percent and seven percent of the state's electricity consumption, respectively.[54] The industrial sector also accounts for a large percentage of the gas consumption in the state.[55] Consequently, improving the efficiency of agriculture and industrial processes presents a significant energy savings opportunity, which was largely realized in the 2010-2012 portfolio. In addition, the industrial and agriculture programs in the 2010-2012 energy efficiency portfolio supported the vision of the Strategic Plan to "significantly improve overall energy performance and help meet both private-sector and national goals for energy and the environment" and "support the long-term economic environmental success of California agriculture."[56]

Reported and Evaluated Savings

At the end of the 2010-2012 program cycle, the IOUs spent approximately $391 million (15 percent of total portfolio expenditures) on industrial and agriculture efficiency programs, resulting in evaluated gross savings of 817 GWh and 137 MW, representing

54 See http://www.energy.ca.gov/2009publications/CEC-100-2009-003/CEC-100-2009-003-CMF.PDF, p. 4.

55 The industrial sector accounted for 25 percent of the natural gas demand in 2012. California Energy Commission, Energy Almanac, at http://energyalmanac.ca.gov/naturalgas/demand_by_sector.html.

56 See Commission Decision D.09-09-047 (Sections 5.5 Statewide Industrial Programs and 5.6 Agricultural Programs). http://docs.cpuc.ca.gov/Published/Graphics/107829.pdf

approximately ten percent of both total portfolio electric savings and demand savings. Approximately 53 and 58 percent of gross electric and demand savings, receptively, were directly attributable to the program interventions. Evaluated gross therm savings were approximately 119 million therms for these two sectors, constituting 73 percent of the evaluated portfolio therm savings; 52 percent of these gross industrial and agriculture therm savings were directly attributable to program interventions.

Table 7. Industrial and Agriculture Sector Savings and Budget Snapshot

		Expenditures	Energy Savings			Emission savings	Cost Effectiveness
		Million ($)	Electric (GWh)	Demand (MW)	Natural Gas (MM Therms)	CO_2 (Million Tons)	TRC
Reported	Gross	391	1,166	208	110	1,292	2.56
	Net		807	147	70	860	1.75
Evaluated	Gross		817	137	119	1,144	2.22
	Net		439	80	62	602	1.20

Lighting and HVAC projects provided a significant component of the savings in the industrial and agriculture sectors. Roughly 23 percent of the evaluated electric savings in the industrial and agriculture sectors came from lighting measures, and about seven percent from HVAC. For natural gas savings, HVAC makes up about eight percent of IOU-reported savings in both sectors combined. The lighting and HVAC program impacts are discussed in separate HVAC and Lighting chapters in this report. However, the claimed and evaluated savings from these end uses are included in the savings reported in this chapter to show their contribution to total savings in the industrial and agriculture sectors.

Overview of Industrial and Agriculture Energy Efficiency Programs

There were 39 industrial programs and 27 agricultural programs in the 2010-2012 portfolio, implemented by the IOUs or by third party implementers. Some programs were directed to specific market segments, such as refineries, wastewater treatment, and dairies, or specific technologies, such as boilers and air compressors. Energy efficiency projects in the industrial and agriculture sectors generally focus on manufacturing process improvements or retrofitting opportunities, but also include standardized and new construction projects. For a majority of projects, energy savings were calculated on a "custom" basis, which means that incentives were calculated on the basis of the energy saved.

In addition, the 2010-2012 portfolio introduced a pilot program aligned with the Industrial, Agriculture, and

Commercial Chapters of the Strategic Plan called Continuous Energy Improvement (CEI),[57] a comprehensive energy management approach that includes performance tracking for purposes of greenhouse gas emissions (AB 32) and energy efficiency efforts. The CEI program had 31 participants across the IOUs.

Highlights

Based on evaluated savings results, the industrial and agriculture programs achieved close to 90 percent of the therm goal for the entire portfolio. Although evaluated net electric savings were approximately 55 percent of IOU-reported net savings, the total amount of savings achieved was very large and the programs were cost effective. The major reasons for differences in reported and evaluated savings are provided later in this chapter in the findings discussion.

To help resolve the issues causing differences between IOU claims and evaluated results, the IOUs and CPUC staff have been engaging in a collaborative process to review and approve project savings estimates prior to implementing projects.[58] The intent of the early review process is to reduce the gap between utility claimed savings and evaluated savings and to provide immediate feedback to the utilities with respect to savings calculation methodologies and program influence metrics. The collaborative early review process proved useful in resolving project-specific questions in the 2010-2012 portfolio period, and the process has continued in the 2013-2014 portfolio period.

As noted above, the IOUs piloted the CEI program in the 2010-2012 cycle, a program that explored alternative strategies for achieving electricity and gas savings in the commercial and industrial sectors. The program provided long-term energy management consulting services to educate and train commercial and industrial energy users to: (1) develop and execute a long-term energy-planning strategy; and (2) permanently integrate energy management into their business planning at all levels of the organization, from shop floor to corporate management. The CEI program has continued as a pilot in 2013-2014.

Findings

Impact Evaluation

The custom program impact evaluation evaluated industrial, agriculture, large commercial, and nonresidential new construction custom projects to verify energy savings claimed by the IOUs.[59] The study included a comprehensive suite of field-based evaluations as well as a qualitative lower rigor assessment (LRA) [60] of additional projects. The sample domains

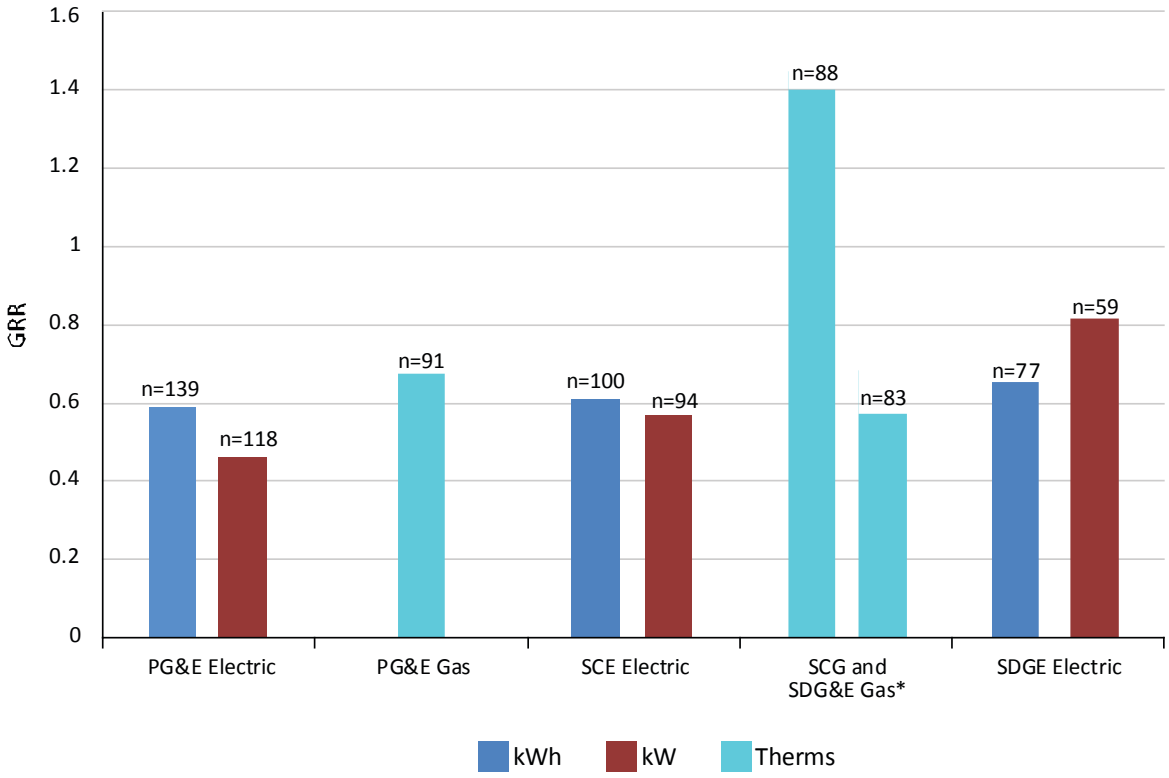
57 Funding for this program activity was about 1.15 percent of the budget for industrial and agriculture programs.

58 This is referred to as the ex-ante review (EAR) process. See Commission Decision 11-07-030, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/139860.pdf; and, Decision 12-05-015, p. 344 ("Our adopted custom measure and project review process was conceived both to help motivate improvements to the ex ante values for those projects and to motivate the utilities to respond to Commission Staff reviews with appropriate program design changes"), available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/166830.pdf.

59 The 2010-12 WO 033 Custom Impact Evaluation Final Report is available at http://www.energydataweb.com/cpucFiles/pdaDocs/1129/2010-12_WO033_Custom_Impact_Eval_Report_Final.pdf; the Custom Impact Evaluation Final Report Appendices are available at http://www.energydataweb.com/cpucFiles/pdaDocs/1130/2010-12_WO033_Custom_Impact_Eval_Report_Final_Appendices_Only.pdf.

60 The LRAs used an engineering desk review of project files to assess programs and program groups. The strength and weaknesses of programs and program groups were assessed through 17 key metrics related to gross impact estimation practices. Key findings addressed the relative performance of IOU and

Figure 2. Project Lifecycle Gross Realization Rates by Sample Domain and Energy Metric (kWh, kW, Therms)*



** The lower number in each IOU fuel domain excludes the most extreme points.*

were IOU and fuel type (with SCG and SDG&E gas projects combined due to the number of projects), and the samples were stratified by size. The evaluation results were based on a gross impact sample of 429 projects and yielded gross realization rates (ratio of gross evaluated savings to gross claimed savings reported by the IOUs) ranging from 0.59 to 1.40 across IOU fuel sampling domains; in other words, the evaluation found that the IOUs achieved from 59 to 140 percent of their reported gross savings, depending on the IOU and fuel type.[61]

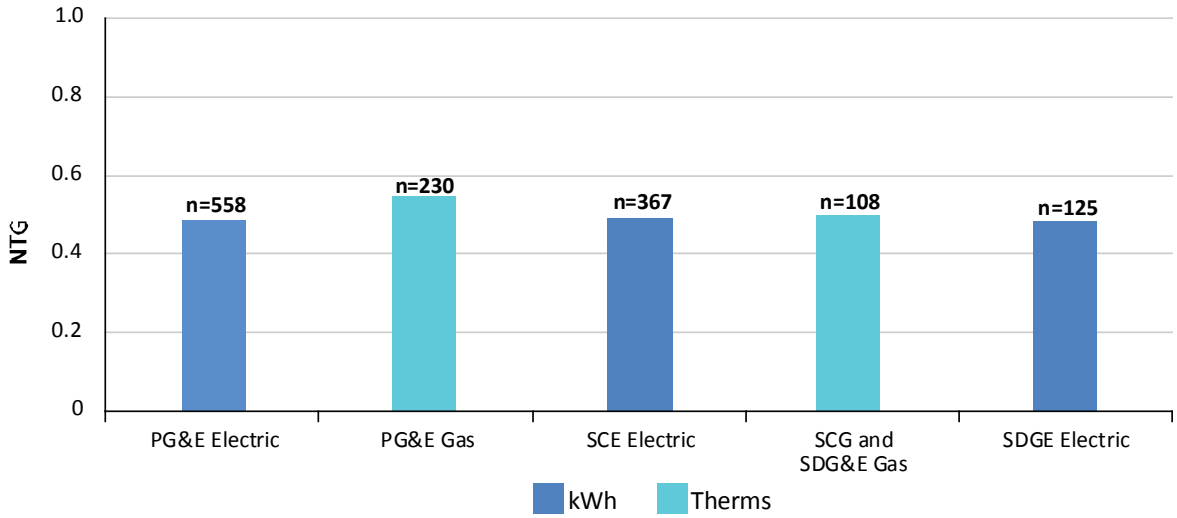
Net to gross ratio (NTGR ; a metric defining the attribution of energy savings to the program) results were based on 1,388 sample points.[62] A much larger custom NTG sample was drawn in this evaluation compared to previous evaluation cycles in order to support a more thorough reporting of results at the program or program grouping level. On a statewide

non-IOU program offerings, including third party, new construction, and government partnership programs.

61 Gross realization rates ranged from 0.58 to 0.67 when the most extreme realization rates were excluded.

62 Net to gross" is a ratio or percentage of net program impacts divided by gross or total impacts. Net to gross ratios are used to estimate and describe the free-ridership that may be occurring within energy efficiency programs. "Free-riders" are program participants who would have installed the program measure or equipment in the absence of the program. California Public Utilities Energy Efficiency Policy Manual, v. 4.0, available at www.cpuc.ca.gov/NR/rdonlyres/FCE88E10-C186-479F-BFFF-CB722750B1AA/0/CPUCEnergyEfficiencyPolicyManual.doc.

Figure 3. Weighted Net-to-Gross Ratios by IOU Fuel Domain*



** Note that these values do not include the effects of nine projects for the limited purpose of calculating an NTGR Adjustment due to the potential overlap for these sites between the NTG for the project and the Industry Standard Practice (ISP) or Dual Baseline determinations in the project gross impact analysis. For further discussion, see the Draft 2010-2012 Custom Net to Gross Report.*

basis, the NTGR across all program categories averaged 0.48 for electric programs and 0.53 for gas programs. The NTGRs for each IOU fuel domain studied ranged from 0.45 to 0.56. [63] These values indicate a medium-high level of free ridership, and a resulting medium-low level of program influence, and are similar in magnitude to NTGRs from the past several evaluation cycles. [64]

The overall net evaluation realization rates (adjusted evaluated savings compared to unadjusted gross claims) for the primary fuel evaluated varied from 0.28 to 0.70 across the five IOU fuel domains.

A novel element incorporated in this evaluation was a qualitative lower rigor assessment (LRA) carried out for 536 custom projects. These lower rigor assessments used an engineering desk review of project files to assess the strength and weaknesses of programs and program groups through 17 key metrics related to gross impact estimation practices.

63 Draft 2010-2012 Custom Net to Gross Report available at http://www.energydataweb.com/cpucFiles/pdaDocs/1162/2010-12%20WO033%20Custom%20Net-to-Gross%20Report%20-%20Draft%20080114.pdf.

64 Statewide California IOU Custom-Type Program Evaluation Net to Gross Ratios, Program Years 1998-2008

**Weighted by incentives rather than by kWh savings.*

From Draft 2010-2012 Custom Net to Gross Report available at http://www.energydataweb.com/cpucFiles/pdaDocs/1162/201012%20WO033%20Custom%20Net-to-Gross%20Report%20-%20Draft%20080114.pdf: The studies are available on http://www.calmac.org.

(1 – Free Ridership)	1998 Non-Res	1999 Non-Res	2000 Non-Res	2001 Non-Res	2002 Non-Res	2004-2005 Non-Res	PY2006-2008 PG&E Ind	PY2006-2008 SCE Ind
Weighted	0.53*	0.51	0.41	0.65	0.45	0.57	Electric - 0.45, Gas - 0.31	0.63

Key findings from the impact evaluation include:

- Documentation for many of the sample projects was insufficient to initiate an appropriate independent analysis and investigation.
- Utility-reported gross impacts differ from evaluated results for three primary reasons: (1) observed changes in operating conditions; (2) baseline specifications (i.e., determination of the "status quo" baseline energy use from which the additional energy savings were measured); and IOU calculation methods. Other reasons for differences that were observed infrequently included incorrect equipment specifications, ineligible equipment, and incorrect measure counts.
- Customer interviews representing 1,388 installed projects were conducted to understand the role of the program and other market factors in their decision to take an energy efficiency action. The information obtained through these interviews was converted into a net to gross ratio. The general conclusions drawn from the results of this large sample were that free ridership remains high for custom programs and further, that few adjustments appeared to have been made during the 2010-2012 portfolio cycle with respect to either the custom program designs or their implementation procedures in order to reduce free ridership. However, free ridership in custom programs is a subject currently being addressed through the design of a guidance document to be used by custom program implementers. Free ridership is also being addressed through collaboration among the IOUs and CPUC staff in connection with the rolling portfolio cycle that is anticipated from 2015 and forward.

Continuous Energy Improvement Program

A process evaluation of the CEI pilot program was conducted by the IOUs and finalized on October 26, 2012.[65] The purpose of the evaluation was to identify possible program improvements and refinements. In October 2013 an impact evaluability assessment for the CEI program was posted.[66] The goals of this assessment were to assess the evaluability of the CEI program based on the data collected, to recommend improvements to data collection, and to demonstrate the methodology for determining energy savings from the CEI program. The key findings from these two studies include:

- In addition to the IOUs gaining program implementation experience, the pilot program was on track to meet the facility-level goals of: (1) engaging facilities in long-term energy planning strategies, and (2) integrating energy management permanently into facility business planning. Participant interview responses support this finding, with all 18 interviewees stating they intended to continue with CEI upon ending their engagement with the program.
- Six main challenges were identified in implementing the program:
  - recruiting participants;

65 The Process Evaluation of California's Continuous Energy Improvement Pilot Program, Final Report, October 26, 2012, is available at: http://www.energydataweb.com/cpucFiles/pdaDocs/902/Cadmus%20CA%20CEI%20Process%20Eval%20Rpt%2026Oct2012.docx.

66 See Impact Evaluability Assessment of California's Continuous Energy Improvement Pilot Program, October 2013, Cadmus, at http://calmac.org/publications/CA_CEI_Pilot_Evaluability_Assessment_REVISED_FINAL.pdf .

- addressing participants who do not progress in the program;
- the lack of financial incentives;
- including comprehensive demand side management strategies in the program design;
- attributing energy savings to the program; and
- attributing spillover to the program.[67]

For the CEI impact evaluability assessment, energy savings estimates were generated for only three of the 10 sample sites due to various factors including slow progress in implementing the program resulting in a small sample size, lack of post-implementation data, and changes in operating conditions. Since this report was not intended to be an impact evaluation of savings but rather an evaluability assessment for future impact evaluations, the result was a set of recommendations to improve the ability to assess CEI savings impacts in the future. The IOUs were also directed to consider lessons learned from the CEI process evaluation described above to initiate improvements in program implementation as well. For more information on the CEI process evaluation recommendations see the Commercial Chapter of this report.

Program Assessments

Two program assessment studies were conducted to look at best practices for a large portion of the state's nonresidential portfolio of programs. The *IOU Core Calculated Program Group Report* and the *Third Party Industrial and Agricultural Program Group Report* were finalized in 2012. They included an assessment of IOU-run ("core") industrial and agricultural programs and an assessment of 28 third party industrial and agricultural programs.[68] The studies identify and discuss best practices in program implementation in these sectors.

The program assessment studies generally concluded that although opportunities exist for program improvements, best practices are generally being followed in this sector with respect to marketing, project management, customer service and installation, and service delivery mechanisms.

Agricultural Market Characterization Study

The *2010-2012 Statewide Agricultural Market Characterization Study*[69] was carried out by the IOUs and was finalized in 2013. The study addressed the following segments of California's agriculture industry: fruit, tree nut and vine crops; vineyards and wineries; dairies; greenhouses and nurseries; mushrooms; field crops; refrigerated warehouses; and post-harvest processing. Surveys involved telephone and face-to-face interviews with agricultural subject-matter experts, growers, dairymen, greenhouse/processing managers, and trade associations. The study found that:

- Availability of water and cheap labor are generally much higher priority than energy use.

67 For the CEI program, spillover occurs when facilities implement projects that are in addition to the CEI plan or when facilities continue practicing CEI after their engagement with the program ends.

68 The IOU Core Calculated Program Group Report is available at http://www.energydataweb.com/cpucFiles/pdaDocs/963/Non%20Res%20Core%20Calculated%20Prog%20Assess.pdf; the Third Party Industrial and Agricultural Program Group Report is available at http://www.energydataweb.com/cpucFiles/pdaDocs/859/3P%20Ag%20&%20Industrial%20Draft%20Report.pdf.

69 See The 2010-2012 Statewide Agricultural Market Characterization Study at http://calmac.org/publications/CA_Ag_Mrkt_Characterization_Final_5-13-13.pdf .

- Concerns about labor availability and cost will likely lead to increased mechanization, which will increase load, suggesting that this presents a good opportunity for utilities to partner with growers/associations before the transition takes place in order to influence decisions toward efficient choices and limit the load growth.
- "First costs" (the initial costs of purchasing and installing energy efficient measures) and financing issues are primary barriers to EE.
- Utilities can improve communications with this segment through their trade partners, associations, equipment vendors, and grass roots organizations.
- Programs based on NAICS codes[70] will be over simplistic because many agricultural customers have multiple operations.

Recommendations

Each of the completed studies provides multiple recommendations for program improvements based on the findings.

Recommendations provided in the Custom Program Evaluation Report include:

- Project documentation should be compiled in one electronic location.
- Develop a final "project close out form" to ensure that all forms, files and data are accounted for and properly stored for later retrieval.
- Baseline specification, documentation and recording – early retirement, replace on burnout, natural replacement and add-on measure, for example – should be an area for concentrated IOU improvement.
- The IOUs should work with CPUC Staff to improve impact estimation approaches and requirements for whole-building and monitoring-based retro-commissioning projects.
- Further investigation is needed in markets with high free ridership to assess whether decisions have already been made before the program becomes involved, and whether installed measures are becoming standard practice, at a minimum.

The CEI process evaluation made a number of recommendations regarding future CEI programs including that the CEI program develop a methodology to quantify program impacts in the form of energy savings; offer incentives such as co-funding an energy manager's salary; leverage other IOU program offerings; offer workforce education and training; encourage a company cohort model in which more than one facility is enrolled; and provide support to participants who seek ISO 50001 certification offered by DOE. [71]

70 North American Industry Classification System (NAICS) classifies business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. economy. The NAICS industry codes define establishments based on the activities in which they are primarily engaged.

71 ISO 50001 is a management system developed by the International Standards Organization that establishes energy management standards. It provides a framework of requirements for organizations to develop a policy for more efficient use of energy; fix targets and objectives to meet the policy; use data to better understand and make decisions about energy use; measure the results; review how well the policy works; and continually improve energy management. http://www.iso.org/iso/home/standards/management-standards/iso50001.htm. The DOE Superior Energy Performance program assists facilities in achieving ISO 50001 certification. http://superiorenergyperformance.energy.gov/,

In addition, the CEI impact evaluation assessment made the following recommendations to be implemented if the IOUs wish to claim energy savings from CEI projects in the future:

- Provide engineering calculations for capital measure savings.
- Collect daily or weekly interval billing and production data.
- Collect more facility baseline data.
- Be aware of the analysis impacts of implementing simultaneous capital and O&M measures.
- Collect data to measure the persistence of CEI projects and actions.
- Perform a statistical power analysis.

With respect to the *IOU Core Calculated Program Group Report* and the *Third Party Industrial and Agricultural Program Group Report*, programs in these sectors should generally be guided by the program assessment best practices recommendations, including improvements that encourage comprehensive and deep retrofits, pursuit of long-term savings, outreach to hard-to-reach customers, participation in CEI programs, and integration of energy efficiency offerings with demand response and distributed generation. Other specific program assessment recommendations include:

- Achieve, for IOU calculated programs, the horizontal integration of program and project data, as well as cross-program databases, customer relationship management systems, and invoicing systems, while vertically integrating systems with upstream and downstream stakeholders including customers, account executives, vendors, third parties, evaluators and the CPUC.
- Dedicate IOU program staff to the development of marketing strategy and materials and leverage the extensive marketing efforts of the private sector.
- Increase third party program opportunities for coordination with IOUs, including co-branding, leveraging marketing, and working closely with account executives.
- Consider different contracting models for third party implementers in addition to paying for performance (such as offering bonus incentives to third party implementers and their customers for pursuing long-term savings objectives).
- Address opportunities for incorporating innovative program design elements, particularly in third party programs.

The *Statewide Agricultural Market Characterization Study* identified the primary opportunity for California utilities as working with existing reference partners (defined as organizations that provide thought leadership) to promote energy efficient measures and practices on a regular basis to overcome existing barriers and address the energy aspects of water and labor issues before these issues become acute. The study also made specific findings and recommendations with respect to each individual segment (fruit, tree nut and vine crops; vineyards and wineries; dairies; greenhouses and nurseries; mushrooms; field crops; refrigerated warehouses; and post-harvest processing).

For More Information

Findings from evaluation results included in this chapter and studies related to industrial and agriculture programs and market studies may be found at www.calmac.org and www.energydataweb.com/cpuc. These studies are listed below:

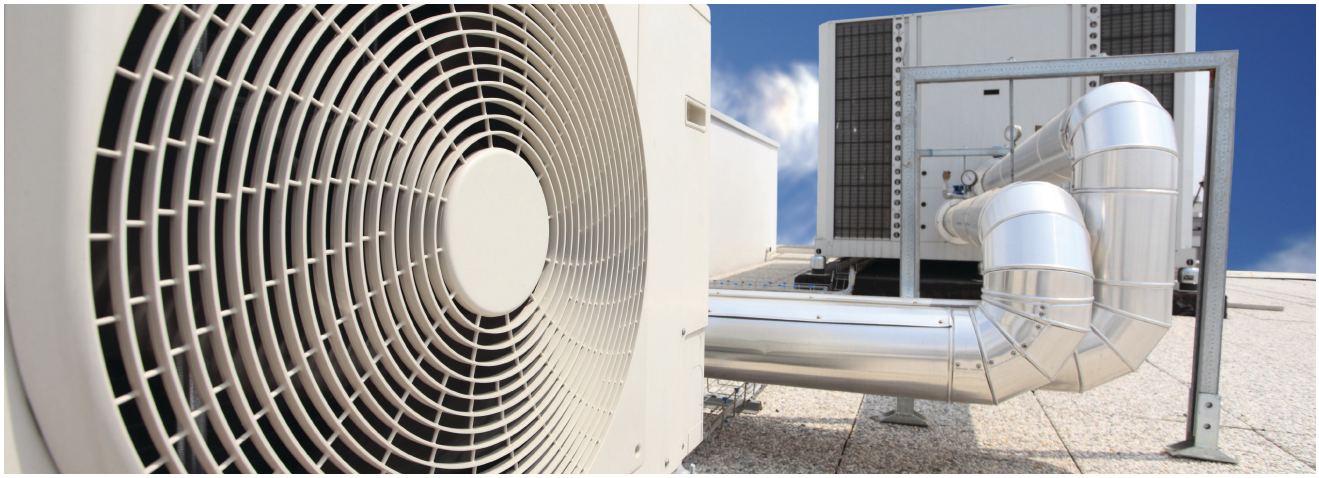
Completed Studies:

- Custom Impact Evaluation Report
- 2010-2012 Statewide Agricultural Energy Efficiency Potential and Market Characterization Study
- California's Continuous Energy Improvement Pilot Program, Final Process Evaluation Report
- Non Residential Program Assessments Study, Third Party Industrial and Agriculture Program Group Report
- Non Residential Program Assessment Study, Core Calculated Program Group Report
- SDG&E Non-Residential Process Evaluation Study: Main Report
- SCG Non-Residential Process Evaluation Study: Main Report

Market Characterization Studies (Included in 2012 Annual Report):

- *Industrial Sectors Market Characterization, Plastics Industry*
- *Industrial Sectors Market Characterization, Mineral Product Manufacturing Industry*
- *Industrial Sectors Market Characterization, Metalworking Industry*
- *Industrial Sectors Market Characterization, Paper Industry*
- *Industrial Sectors Market Characterization, Chemicals Industry*
- *Industrial Sectors Market Characterization, Glass Industry*
- *Industrial Sectors Market Characterization, Cement and Concrete Industry*
- *Industrial Sectors Market Characterization, Water and Wastewater Industry*

Heating, Ventilation and Air Conditioning



Overview

The rapid growth of air conditioning units in California has made heating, ventilation and air conditioning (HVAC) one of the largest energy end uses and the single largest contributor to peak demand. The California Energy Commission estimates that cooling buildings comprises up to 30 percent of total demand in the hot summer months, and that poor installation and maintenance may result in potential energy losses of 20 to 30 percent.[72] As the use of space cooling and heating has increased, the state has struggled to encourage the market to adopt higher efficiency units and develop a sustainable, quality-focused Heating, Ventilation and Air Conditioning (HVAC) industry. To address these issues, the Strategic Plan called for a "transformation" of the industry to ensure that HVAC technology, equipment, installation, and maintenance are of the highest quality to promote energy efficiency and peak load reductions. To meet these objectives, the IOUs designed four core programs to transform the industry by encouraging the purchase of highly efficient HVAC units and demonstrating to property owners that quality installation and proper maintenance of HVAC systems leads to increased savings, greater comfort, and improved indoor air quality. The four IOU core programs are the HVAC Commercial Upstream Incentive, HVAC Commercial and Residential Quality Maintenance, HVAC Commercial and Residential Quality Installation and third party HVAC Tune Up programs.

72 California Energy Commission, Strategic Plan to Reduce the Energy Impact of Air Conditioners (June 2008), http://www.energy.ca.gov/2008publications/CEC-400-2008-010/CEC-400-2008-010.PDF

Estimated Savings

At the end of the 2010-2012 program cycle, the IOUs spent approximately $161 million (6 percent of total portfolio expenditures) on core HVAC efficiency programs, resulting in evaluated savings of 170 GWh and 70 MW, representing approximately 2 percent of total portfolio electric savings and 5 percent of total portfolio demand savings. Approximately 76 percent of electric savings and 78 percent of demand savings were directly attributable to the program interventions.

their portfolios to be cost effective on a combined basis, recognizing that individual programs may not be cost-effective, especially in their nascent stages or after significant re-designs. [73]

HVAC Energy Efficiency Programs

The IOUs' four core HVAC energy efficiency subprograms cover various transaction points in the HVAC industry. The Commercial Upstream Equipment Incentive works with distributors to provide high efficiency HVAC equipment in the market. The

Table 8. HVAC Sector Savings and Budget Snapshot

		HVAC						
		Expenditures	Energy Savings			Emissions	Cost Effectiveness	
		Million ($)	Electric (GWh)	Demand (MW)	Natural Gas (MM Therms)	CO_2 (Tons)	TRC	PAC
Reported	Gross	161	197	79	1	128	0.86	1.29
	Net		143	59	1	93	0.68	1.03
Evaluated	Gross		170	70	1	113	0.76	1.14
	Net		130	54	1	86	0.65	0.97
Percent Evaluated	Gross		71.0%	74.0%	65.5%			
	Net		70.1%	73.1%	65.2%			

Other programs within the IOUs' portfolios, largely in the commercial and residential sectors, include measures that improve the efficiency of HVAC systems as well, so the HVAC-specific programs do not account for all HVAC-related energy savings achieved in the portfolio. Savings from HVAC measures achieved in various sectors are also included in the sector-focused chapters. As indicated in Table 8, HVAC programs are not cost-effective in the 2010-12 portfolio, though it is important to stress that the CPUC requires the IOUs to design and implement

Commercial Quality Installation and Residential Quality Installation programs both aim to improve contractor practices at the point of installation. The Residential and Commercial Quality Maintenance programs support improved contractor maintenance of HVAC systems in operation.

73 Cost-effective HVAC programs included SDG&E's Third Party programs (Res and Non-Res HVAC Tune Up) and SCE's Upstream Equipment Incentive program.

In addition to these core programs, PG&E and SDG&E are implementing third-party Commercial HVAC tune up programs delivered by third-party contractors. These third party HVAC programs comprise 43 percent of IOU 2010-12 HVAC program gross savings claims, but they were not targeted for an impact evaluation for this period. Altogether, the IOU core and third party programs were designed to encourage the adoption of industry-backed, nationally and internationally vetted installation and maintenance standards accredited by the American National Standards Institute (ANSI); educate contractors and property owners about energy efficiency choices; and, promote the best technologies available.

Highlights

The 2010-2012 program cycle produced a number of positive developments. First, the statewide Upstream HVAC Equipment Incentive Program, originally designed and launched by PG&E in 1998, exceeded energy savings targets, particularly in SCE's service territory. The upstream program success is due in large part to a program design that provides the efficiency rebate to the distributor instead of the customer. Providing the rebate to HVAC equipment distributors reduces administrative costs and leverages a small number of distributors and manufacturers to influence thousands of customers' equipment choices. In 2012, PG&E followed SCE's lead in adding measures and providing these "upstream" distributor rebates for commercial Variable Refrigerant Flow HVAC systems. Since this inclusion, PG&E, like SCE, has seen a surge in higher efficiency rebated units.

Another key factor in improving overall HVAC program performance was the development of the Western HVAC Performance Alliance (WHPA), a voluntary advisory organization chartered to help guide the state in achieving the goals outlined in the Strategic Plan. The WHPA has proved effective in bringing together key stakeholders from the HVAC industry, the IOUs, CPUC, CEC and academia to focus their collective efforts on the most pressing challenges facing the industry. In 2012 the WHPA committees were active in helping the IOUs continuously improve their HVAC programs especially with the feedback they provided for the Commercial HVAC QM. All stakeholders expect to get continued support from the WHPA and their respective working committees in setting up two new residential HVAC pilots. WHPA membership tripled from 51 organizations in January 2011 to 151 by the end of 2012, with all major HVAC industry organizations represented and actively involved in this collaborative effort. In 2012, on average 22 stakeholder meetings were conducted per quarter on HVAC energy efficiency topics via the WHPA collaboration forum.

Findings

The CPUC's 2010-12 *HVAC Impact Evaluation Final Report* assessed the gross and net savings claims from the IOUs for the measures in the 2010-12 Upstream, QI/QM and Third-Party HVAC programs. The evaluation determined the IOU HVAC programs' savings through field and laboratory testing, metering, and diagnostic testing of the systems. The evaluation also directly observed technician practices to assess training and skill level and recommend areas of improvements where needed. Finally, the research assessed new service activities performed by technicians for the HVAC system, while obtaining more precise savings estimates for individual service elements of HVAC technician practices. Some key findings included:

- The evaluation efforts for the HVAC Commercial Equipment Upstream program focused on the level of free-ridership. The analysis was based on in-depth telephone interviews with 19 out of 22 participating HVAC distributors and took into account the program's effect on both the stocking practices and sales practices of the distributors.
  - Overall, the program achieved a savings-weighted net-to-gross (NTG) score of 0.80. The final net-to-gross ratio was applied to gross energy and demand savings for 2010-12 programs, with SCE's program representing a majority of the statewide savings for the Upstream program. The net-to-gross ratio reflects the extent to which the program intervention was the primary driver motivating distributors to stock and sell high efficiency HVAC units.
- The residential quality installation field assessments focused on residential systems, as the non-residential quality installation programs were not in full operation in 2010-12.
  - The field assessments compared field findings to baseline assumptions contained in program savings estimates and generally found baseline conditions to be better than assumed. For instance, baseline total system duct leakage levels after installation for non-participants was 17 percent rather than the assumed 24 percent, and only 13 percent of non- participating contractors oversized HVAC systems compared to the assumption that 20 percent do so.
  - The study found that the original gross savings estimates were too high. After adjusting for information gathered in the field, the savings were about 35 percent of the original estimate for electric energy savings and 38 percent for demand savings for the six types of HVAC units studied. These realization rates did not reflect an attempt to estimate the extent to which participating contractors might have complied with Title 24 code installation requirements absent the study; consequently, the program's evaluated net savings reflect the default net-to-gross ratio of 70 percent provided in the utility workpapers for this program.
- The commercial quality maintenance study gathered field observations on installation rates, contractor maintenance practices and observed several challenges with program implementation.
  - Across all sampled units with pre/post monitoring, the gross savings per ton were negative for the statewide package of measures. The overall pooled results across all sites with pre/post monitoring indicate impacts were not statistically different than zero savings with individual results at positive and negative extremes. The results are from a limited sample and are considered indicative, but not definitive based on the calculated uncertainty in the measured savings. The variability in the per-unit savings was much larger than assumed by workpapers or in evaluation planning.
  - Energy savings estimates for the statewide commercial quality maintenance program were driven by marginal unit efficiency changes from most maintenance activities coupled with significant increases in unit

energy consumption caused by increasing the opening of the minimum outside air damper. The increased loads from opening economizer dampers diminished any efficiency improvement benefits obtained from implementation of other maintenance measures. In these cases, the economizers did not function effectively before or after maintenance, and opening of dampers resulted in additional ventilation air loads.

  - The study found that contractors inappropriately opened economizer dampers and did not complete controls adjustments. It showed a 23 percent installation rate for economizers and a 79 percent installation rates for refrigerant charges.
- The poor savings and installation rates found in the evaluation stem from attempts to address individual faults or subsets of all faults without accounting for underlying system issues.
- Classes do not provide sufficient training on tool specification, diagnostic protocols, or feedback for technicians to improve energy efficiency.

The *Lab Test* evaluation team evaluated economizer operation and performance and system faults for dual and single-compressor roof top units (RTU). Master technicians oversaw laboratory technicians who fully instrumented and tested packaged HVAC units in an AHRI-certified laboratory. Results of the 7.5-ton dual-compressor packaged roof top unit tests provided the following preliminary conclusions:

- All tests show that even optimally adjusted systems with an economizer perform significantly lower than their rated efficiency.
  - Tests of the economizer open from 10 percent to 30 percent indicated that efficiency is reduced by 5 percent to 62 percent compared to closed dampers (which deliver 15 percent outdoor air).
  - Outdoor airflow was 15 percent with closed dampers, 20 percent with 1-finger open, 23 percent with 2-fingers open, 30 percent with 3-fingers open, and 62 percent with dampers fully open. Designers, technicians, and program implementers incorrectly assume 2 percent outdoor airflow with closed dampers and 100 percent outdoor airflow with fully open dampers.
  - Minimum damper position of 3-fingers open (30 percent outdoor air) reduced efficiency by 10 percent to 62 percent and reduced economizer savings by approximately 50 percent compared to closed damper.
- The diagnosis and adjustment of charge is difficult, if not impossible, to achieve in the field since the airflow and economizer affect unit performance.
- The test results demonstrate that reducing minimum damper position can be a more reliable measure to improve cooling efficiency.
- Many of the field instruments used in HVAC maintenance activities are unable to accurately measure whether the refrigerant system needed additional charge at various temperature conditions.

The CPUC's *Baseline Characterization Market Effects Study: Residential and Small Commercial HVAC Quality Installation and Quality Improvement Programs in California* assessed baseline market saturation, contractor and customer awareness and contractor practice conditions during 2010-12. Overall, the study found significant market shares of energy-efficient HVAC equipment sold in 2011 and 2012 in California but low baseline values for adherence to Quality Installation (QI) and Quality Maintenance (QM) practices. Some findings included:

- 57 percent of all HVAC units sold to residential and small commercial customers in 2011 and 2012 met the criterion of "climate appropriate air conditioner" using SCE's definition of Tier 1 equipment or better as a proxy.[74] Based on a Tier 1 standard, the current estimate of sales exceeds the goal set by the California Energy Efficiency Strategic Plan for 2015 (15 percent) and approaches the more ambitious goal for 2020 (70 percent). Only 13.5 percent of HVAC units sold in 2011 and 2012 would meet a higher climate-appropriate standard of Tier 2 or better.
- The baseline for contractor quality installation practices is low. Only a minority of contractors (42 percent residential and 36 percent small commercial) were aware of the Air Conditioning Contractors of America (ACCA) Standard 5 quality installation requirements, and a small minority said they adhere to all of its specifications (14 percent and 8 percent of all residential and commercial contractors respectively). Only a very small percentage of installation contractors, ranging from 1 to 3 percent, depending on the IOU, have been trained and qualified by the IOUs for their QI program.
- Customer awareness of the concept of quality installation is also low. Fewer than a fifth of residential respondents (16 percent) and small commercial respondents (17 percent) had heard of the term quality installation.
- Regarding quality maintenance, a minority of contractors (45 percent residential and 34 percent small commercial) were aware of ACCA quality maintenance standards (ACCA Standard 4 or ACCA/ASHRAE Standard 180), and a small minority said they adhere to all of the appropriate specifications (10 percent of all residential contractors; 7 percent of all small commercial contractors). Only a small percentage of maintenance contractors, ranging from 1 to 10 percent, depending on the IOU, have been trained and qualified for program participation by the IOUs.
- For customers, only about 20 percent of both residential and commercial HVAC customers had heard of the term quality maintenance even while 24 percent of residential customers and 58 percent of small commercial customers said they have maintenance done on their HVAC systems every year, outside of regular repair needs.
- The California Contractors State License Board (CSLB) estimates that there are between 12,000 and 16,000 contractors who have C-20 licenses, but as many as 60,000 unlicensed contractors operating in California. These unlicensed contractors place cost

74 Performance tiers were defined using the 2010-2012 SCE Qualifying Minimum Equipment Efficiencies & Incentive Levels for Commercial Air Conditioners. The number of tiers and tier standards, defined based on minimum unit SEER, EER, or IEER ratings, vary by HVAC unit type and capacity.

pressures on all contractors and undercut adherence to QI and QM procedures.

The IOUs conducted two additional HVAC evaluation studies in the 2010-12 cycle. The IOU *California HVAC Contractor & Technician Behavior Study* sought to understand the businesses that perform HVAC maintenance and installation, along with their business models, and to inform future California IOU HVAC program design. Some major findings included:

- The HVAC activities that the CPUC, IOUs, and industry stakeholders such as Air Conditioning Contractors of America (ACCA), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), North American Technician Excellence (NATE), HVAC training organizations, and others desire to promote are at odds with many of the practices prevalent in current contractor business models.
- The prevailing contractor business model is focus on providing the minimum possible service for the lowest possible price rather than on quality-driven customers by providing quality service at the applicable price.

The IOU study *HVAC Permitting: A Study to Inform IOU HVAC Programs* assessed HVAC system replacements ("change outs") to estimate the proportion of change outs that applied for a mechanical permit as required by local building code. It also examined to what extent energy efficiency performance differs for three energy-related metrics – duct leakage, airflow, system sizing – in residential change outs that did and did not receive a permit. While emphasizing that it used sampling methods from multiple data sources and so the findings are not statistically rigorous enough to extrapolate to the entire state, the study nonetheless identified some preliminary permit rates by category, roughly in line with common expectations for permit rates for HVAC change outs of 10-30 percent.

In addition, the study found negligible difference in

Table 9. Rate of Permitting by Sample Type

Sample Type	Sample Target	Number Found (Permit, No Permit, or Exempt)	Number Found with HVAC Permits	Percent Found with HVAC Permits
Non-Participant Residential	52	52	20	**38%**
Non-Participant Commercial	48	48	6	**13%**
Upstream (SCE) Commercial	136	116	37	**32%**
Upstream (PG&E) Commercial	114	105	27	**26%**

Source: HVAC Permitting: A Study to Inform IOU Programs (DNVGL, 8/22/2014; pg 4-5)

a barrier to conducting quality maintenance. The field observations and the survey results suggest that contractors and technicians may

average duct leakage levels – less than one percent – between permitted and non-permitted HVAC

change outs that did not take part in the IOU HVAC QI program.

Recommendations

The CPUC's *HVAC Commercial Equipment Upstream* impact study recommended the following:

Table 10. Total Duct Leakage for QI Non-Participants

Type	Sample Size	Average Duct Leakage (%)	Standard Error	90% Confidence Interval	Relative Precision
Permitted	15	16.1	2.31	3.80	23.6%
Non-permitted	20	16.9	1.88	3.09	18.3%

Source: HVAC Permitting: A Study to Inform IOU Programs (DNVGL, 8/22/2014; pg 5-6)

- The program should consider increasing rebate levels for higher efficiency equipment to encourage more sales in the highest efficiency tiers.
- Program- provided support for how to market high efficiency equipment support may be helpful to distributors.
- Providing a reservation system or rebate guarantee would encourage more participation and increased high-efficiency sales, from distributors who have long sales cycles or customer build equipment.

The CPUC's *Residential HVAC Quality Installation impact* study recommended that IOU savings estimates be revised to consider that baseline or net savings is comprised of a range as opposed to a point estimate and that net savings may vary by code jurisdiction correlated to climate zone and unit cost correlated to SEER level. It also recommended that the IOUs explore some areas where Title 24 can be exceeded or does not have requirements, such as program components to support:

- Downsizing to reduce peak demand. The program sizing aligned much better with Manual J load calculations than non-participants, but did not eliminate all cases of oversizing.
- Duct sealing to reach a lower target leakage, such as the 6 percent threshold that is set for new ducts systems.
- Air handlers/furnaces, filters, and duct modifications that reduce pressure drop and improve fan system efficiency.

The CPUC's *HVAC Commercial Quality Maintenance* study recommended that:

- The program should take a comprehensive approach to diagnostics and maintenance going forward, since multiple factors affect traditional unitary diagnostic measurements. Such an approach would require that retro-commissioning be completed prior to ongoing maintenance.
- The IOUs clearly define measures and programs based on the repairs and actions that will improve energy efficiency and reduce peak demand (rather than all repairs and actions). A focus should also be placed on the ongoing maintenance activities that lead to more persistent savings, rather than all maintenance activities. Repairs and maintenance activities that improve comfort, indoor air quality, or unit life may impact efficiency and/or the load the equipment place on the system to some degree and should be accounted for if performed.
- Incentives are provided for approaches/measures with the highest probable applicability, FDD repair rate, and savings. Steps or measures might include: sealing unit leaks; reconsidering diagnostic-based refrigerant change measures; using manufacturer maintenance and diagnostic protocols; and developing criteria to replace rather than repair HVAC economizers.

The CPUC's *Baseline Characterization Market Effects Study: Residential and Small Commercial HVAC Quality Installation and Quality Improvement Programs in California* recommended that design and implementation of IOU HVAC programs:

- Focus on educating customers about the value of quality installation and maintenance.
- Collaborate with industry leaders to train contractors so that they have their NATE certifications in place.
- Step up efforts to have contractors participate in the IOU training programs.

The IOUs' *California HVAC Contractor & Technician Behavior Study* presented recommendations for each market actor group that should be prioritized to overcome the barriers presented by current contractor business models:

- Educate technicians and contractors on the specifics of the ACCA/ASHRAE installation and maintenance standards through active outreach, and training and education on standards, as well as educating technicians on presenting the value proposition to customers.
- Investigate how industry standards are communicated to technicians and how contractors follow up with technicians to ensure that standards are enacted in the field.
- Determine how quality installation (QI) and quality maintenance (QM) programs should

be branded, and what the primary message should be based upon.
- Develop sales and technical training for contractor firm staff, by researching best practices in sales training processes/approaches specific to HVAC services.
- Develop analysis tools that help make the value proposition to customers clear about QI and QM.

For More Information

Findings from initial evaluation results included in this chapter and studies related to HVAC may be found at www.calmac.org and www.energydataweb.com/cpuc/. These studies are listed below:

Completed Studies

- HVAC Impact Evaluation Report: WO32 HVAC- Volume 1: Report and Volume 2: Appendices
  - This study includes impact evaluation results for the IOUs HVAC Quality Installation and Maintenance Programs, and Upstream Program, and HVAC Lab Testing Study results
- The California HVAC Contractor & Technician Behavior Study
- Baseline Characterization Market Effects Study: Residential and Small Commercial HVAC Quality Installation and Quality Improvement Programs in California
- HVAC Permitting: A Study to Inform IOU HVAC Programs

Other Resources

California Energy Commission, Strategic Plan to Reduce the Energy Impact of Air Conditioners (June 2008), http://www.energy.ca.gov/2008publications/CEC-400-2008-010/CEC-400-2008-010.PDF

Codes and Standards

Overview

The Codes and Standards Program conducts research and advocacy to support adoption of energy efficiency technologies and practices in California Building Energy Standards (Title 24) and Appliance Standards (Title 20) and U.S. Department of Energy Appliance Standards, as well as compliance enhancement and other code support activities. The IOUs' Codes and Standards program provides vital technical and market research on market readiness and cost-effectiveness of measures under consideration for code adoption. Supporting the transition of a new product or practice into a code-appropriate industry standard reduces the overall cost of energy efficiency and spurs additional innovation.

Savings from codes and standards are arguably the most cost-effective savings to be captured. Energy savings from codes and standards that are evaluated and are a direct result of the program intervention count toward the CPUC adopted goals for the portfolio and are an important component of forecasting future load.[75]

Energy Savings

The 2010-2012 Statewide Codes and Standards Program spent $30 million, which is less than one percent of the total energy efficiency portfolio budget, and accounted for an estimated 30 percent of the verified net portfolio savings. Nearly all portfolio Codes and Standards savings come from the buildings

75 Commission Decision D.10-04-029

and appliances advocacy subprograms, therefore the impact evaluation focused on the activities of these two subprograms. The Reach Codes subprogram presented estimates for around 0.5 percent of the C&S savings. The Compliance Enhancement subprogram (CEP) was changed to a non-resource activity mid-cycle.

Code and Standards savings estimates are available as projected at the beginning of the cycle but evaluated on an ex-post basis. Table 11 below shows the original estimates and the evaluated savings for the 2010-12 program cycle. [76]

Based on program attributable and verified savings, the program is cost-effective with a TRC of 3.64. This is in part due to the low program costs but also because code and standard changes impact all customers in the utility territories, not just program participants.

Codes and Standards Programs

The Codes and Standards Program[77] engages with code-setting bodies such as the California Energy Commission (CEC) and the U.S. Department of Energy (DOE) to directly influence the development of codes and standards that strengthen energy efficiency regulations. This activity is largely achieved by conducting research for specific code changes known as Codes and Standards Enhancement (CASE) reports, some of which are used by the CEC to set new standards. The program supports federal standards by engaging in both administrative and legislative processes together with other stakeholders. The Codes and Standards program also engages in compliance improvement activities for California standards by:

- Supporting building advocacy efforts through education and training initiatives.

Table 11. Codes and Standards Sector Savings and Budget Snapshot

	Expenditures (million $)	Energy Savings				
		GWh	MW	Mtherms***	CO_2	TRC+
Projected (Gross)*	$30	4,976	906	57.64 (-0.83)		
Projected (Program Net)**		2,248	398	33.17 (4.81)		
Verified (Gross)*		6,536	1,250	(6.50)	3,338	
Verified (Program Net)**		2,203	374	11	1,171	3.64

** Gross Savings are IOU territory potential savings adjusted for the Compliance Adjustment Factor.*
*** Program Net are IOU territory Gross Savings adjusted for Naturally Occurring Market Adoption (NOMAD) and Attribution of activities to the program.*
**** Gas savings are without interactive effects.*
+There are minor discrepancies between final evaluated savings and savings used to calculate the TRC due to the need to import savings and costs into the cost-effectiveness tool (CET). It was not possible to reconcile the differences for this report, but Energy Division is working to integrate the systems to avoid this in the future. Further details of this process are available in the Appendices.

76 . Due to time lag between verified savings used in this report and the publishing of final evaluation results, there may be discrepancies in final verified savings...

77 Program and subprogram descriptions can be found in the Codes and Standards Program Implementation Plans, 01/03/2011. See www.eestats.cpuc.ca.gov .

- Implementing a Best Practices Pilot involving seven jurisdictions, as part of the Compliance Enhancement subprogram.

The Codes and Standards Program also supports local jurisdictions in the development and implementation of reach codes, which exceed minimum statewide code requirements. [78]

Highlights

Highlights from the comprehensive 2010-2012 IOU-reported Program Performance Metrics [79]; Compliance Enhancement and Reach Codes evaluations, concluded in 2013[80] ; and Codes and Standards Advocacy savings evaluation, concluded in 2014[81], include:

- The program achieved nearly all of estimated savings, but there were wide variations for individual standards. Advocacy activities achieved 98 percent of estimated savings for energy, 94 percent for demand and 62 percent for gas.
- Most (72 percent) of the program savings came from improvements in appliance

Figure 4. Net Program Savings by Standard Group

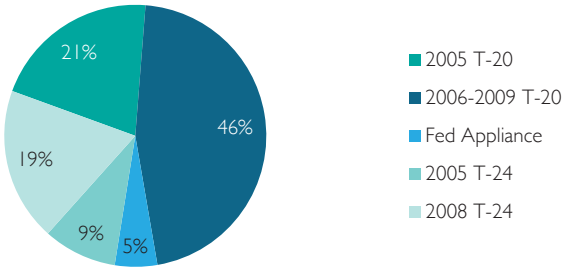


Table 12 – Statewide C&S Building Standards Topics*

Sectors	Research and Analysis	Docketed	Adopted
Nonresidential	19	19	17
Residential	15	13	12
Crosscutting	21	19	17
Other	9	9	9
Total	64	60	55

**Source: IOU and ED email communication 9/12/2013*

78 Based on Decision 10-04-029 at 46; CPUC defines Reach Codes as codes that must be adopted formally by an enforcement jurisdiction. The code must be legally enforceable and enforced by the jurisdiction, and it must apply to all entities within the adopting jurisdiction.

79 The IOU-reported IOU Program Performance Metrics (PPMs) are available at www.eestats.cpuc.ca.gov.

80 Codes and Standards Reach Code Subprogram 2010-2012 Process and Pilot Impact Evaluations, available at http://www.calmac.org/publications/PY2010-2012_Reach_Code_Study_Published.pdf and California Statewide Codes and Standards Compliance Enhancement Subprogram PY2010-2012 Pilot Process Evaluation, available at http://www.calmac.org/publications/CEP-Report_FINAL_PUBLISHED.pdf .

81 Statewide Codes and Standards (C&S) Program Impact Evaluation Draft Report For Program Years 2010-2012 http://www.energydataweb.com/cpucFiles/pdaDocs/1163/CS%20Evaluation%20Report%20DRAFT%20081920l4.pdf; Appendices: http://www.energydataweb.com/cpucFiles/pdaDocs/1164/CS%20Evaluation%20Report%20Appendices%20DRAFT%208192014.pdf

standards with advocacy between 2005 and 2009 (Title 20 and federal standards).

- The statewide program conducted research and analysis on 64 building standards topics, and developed and docketed 60 CASE studies, of which 55 were adopted by the CEC for T-24.
- The statewide program conducted research and analysis on 16 appliance standards topics, and developed and docketed one CASE study proposal on battery chargers as requested and adopted by the CEC in 2012.
- The statewide program also supported the California Quality LED specification, even though they did not produce a CASE study.
- The remaining 15 CASE studies developed by the statewide program (covering 17 product categories) were initiated in 2010-2012, but completed and docketed at the CEC in 2013. The IOUs are advocating for adoption of these topics in the standards in 2014.
- The statewide program delivered a total of 153 training sessions from 2010 to 2012, as part of its Compliance Enhancement activities.[82] Moreover, the program implemented a Best Practices Pilot to identify gaps and best practices in seven jurisdictions. The results of this pilot are informing ongoing compliance improvement activities in 2013-2014, findings from an evaluation of the pilot are included in the next section.[83]
- The Reach Code sub-program supported 34 local governments in their adoption Reach Codes by providing cost-effectiveness studies to meet CEC approval requirements. Findings from an evaluation of the subprogram were focused on the fact that the local jurisdictions saw these studies as necessary but not sufficient, as another barrier to adopting reach codes is political will, which the program does not directly address.

Findings

Several studies completed since 2012 provide valuable insights about Codes and Standards program activity, including a statewide IOU led Codes and Standards Program process evaluation[84], finished in early 2012, a process evaluation of the Reach Codes (RC) subprogram and Best Practices Pilot which were finalized in early 2013 and an impact evaluation finished in 2014.

82 The SW program delivered 79 role based training sessions in 2012, 59 in 2011 and 15 in 2010.

83 The Best Practices Report and some of the online tools developed as a result of the pilot can be found at www.T24Ace.com

84 2010–2012 California Statewide Codes and Standards Program Process Evaluation Final Report available at http://www.calmac.org/publications/SCE-PG%26E_C%26S_Process_Evaluation_FINAL_5-28-12.pdf

Table 13 - Comparison of Evaluated Savings to IOU Estimates by Analytic Step

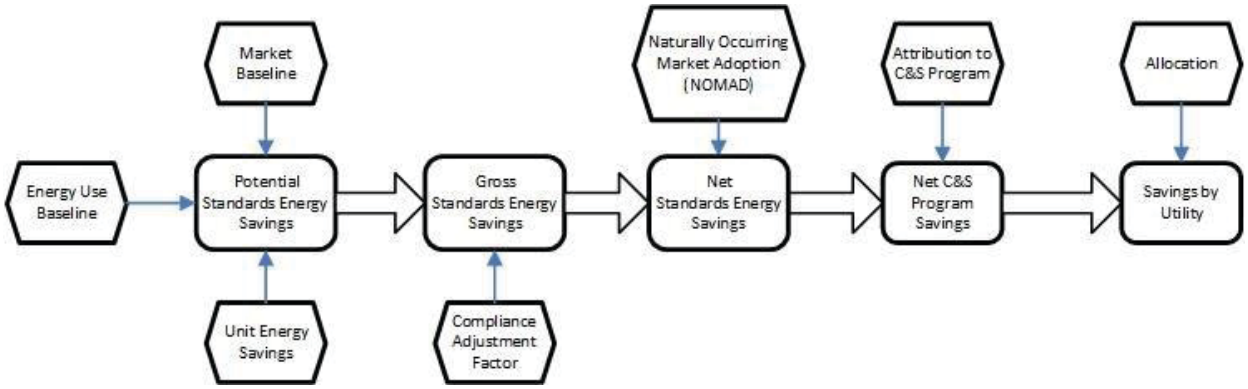
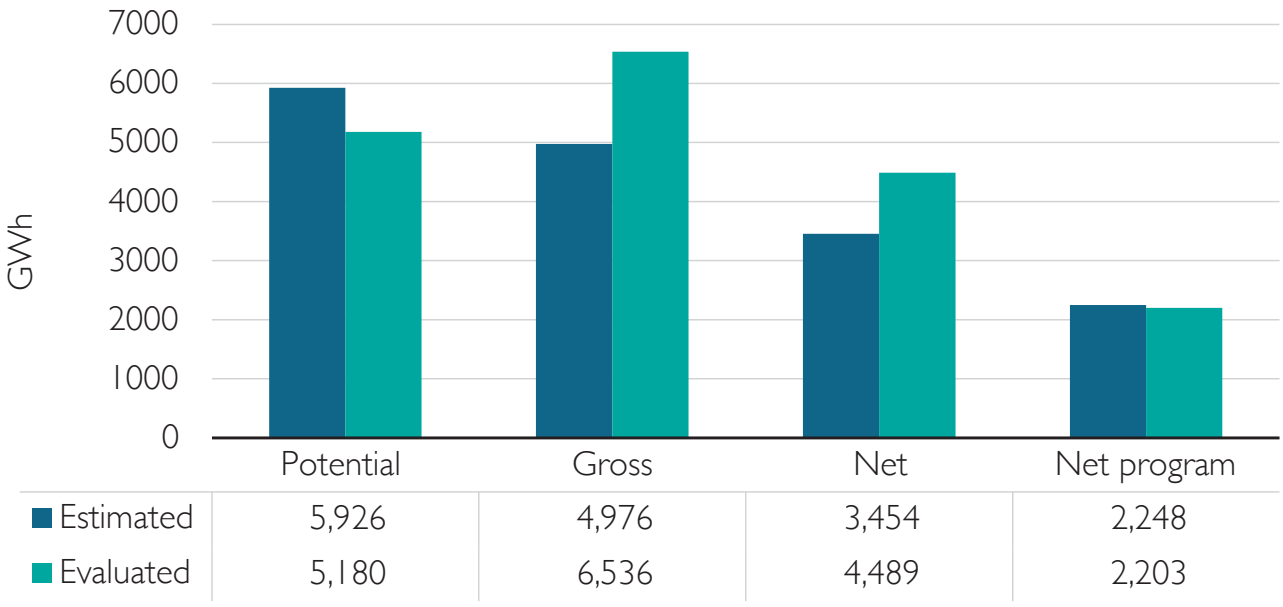


Figure 5. C&S Advocacy Program Evaluation Protocol (Estimated vs. Evaluated)



Impact Evaluation Findings

The impact evaluation of advocacy activities was completed in mid-2014[85]. The evaluation process is designed to assess the Code and Standards advocacy savings claims.[86]

Even though 72 percent of the evaluated savings for Code and Standards resulted from appliance standards advocacy – both state and federal – much attention is paid to Building standards (Title 24) evaluated savings and most specifically the Compliance Adjustment Factor (CAF) and Compliance Rates (CR). This is due mainly to compliance is estimated to be very low for some standards – for instance residential HVAC replacements. As stated earlier, the determination of compliance adjustments for Title 24 is resource intensive, involving field audits of buildings and modelling analysis. [87] The impact evaluation of the 2006-2008 program years[88] concentrated on Title 24 compliance of residential buildings. Nonresidential construction represented 69 percent of the statewide total construction value (in 2010 and 2011). In addition, analysis of the IOU estimated savings revealed that about 78 percent of nonresidential savings and 63 percent of all 2008 Title 24 savings were expected to result from new construction and lighting alteration projects.

85 Statewide Codes and Standards (C&S) Program Impact Evaluation Draft Report For Program Years 2010-2012 http://www.energydataweb.com/cpucFiles/pdaDocs/1163/CS%20Evaluation%20Report%20DRAFT%2008192014.pdf; Appendices: http://www.energydataweb.com/cpucFiles/pdaDocs/1164/CS%20Evaluation%20Report%20Appendices%20DRAFT%208192014.pdf

86 California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals http://www.cpuc.ca.gov/NR/rdonlyres/27629E7A-F01A-48CA-8B2C-B07ECEE7DD5A/0/CAEnergyEfficiencyEvaluationProtocols.doc

87 About 40% of the budget was spent on the compliance analysis part of the evaluation. Over 129 thousand permit records were received from Building Departments across the state but only 197 were successfully analyzed. The majority of issues encountered were due to eligibility of records.

88 Codes & Standards (C&S) Programs Impact Evaluation California Investor Owned Utilities' codes and standards Program Evaluation for Program Years 2006-2008. Available at http://www.calmac.org/publications/Codes_Standards_Vol_III_FinalEvaluationReportUpdated_04122010.pdf

Within the context of energy-efficiency programs, the word compliance has different meanings to different audiences. This impact evaluation determined compliance in two different ways, using different methods of calculation:

applied to new construction and alterations, a weighted average of the factor was applied. If it was not possible to verify the compliance factor, the evaluation defaulted to IOU estimated values.

Table 14. Definition of Compliance Rate and Adjustment Factor

Term	Definition	Methods
Compliance Rate (CR)	A measurement of the total installed building measures or equipment that complies with current code requirements.	**Appliances** Ratio: (equipment that meets the current standard) / (total market volume) **Buildings** *Prescriptive* Ratio: (equipment that meets the current standard) / (total market volume) *Performance* Ratio: (annual energy consumption of building that just meets the current standard) / (annual energy consumption of building as built)
Compliance Adjustment Factor (CAF)*	Measurement used to adjust IOU savings claims. Part of the Integrated Standards Savings Model to calculate savings impacts.	**Appliances** Ratio: (equipment that meets the current standard) / (total market volume) **Buildings** Ratio: (gross savings) / (potential savings) calculated as $CAF = \frac{(2005 - AsBuilt)}{(2005 - 2008)}$

** The methodology for the Complince Adjustment Factor was defined during the 2006-2008 C&S Impact evaluation and is based on: a) the potential of a standard update is calculated as the gain in efficiency from a baseline standard; b) the majority of buildings comply with the code using the performance approach.*

The evaluation focused on four standards categories based on their magnitude of savings: nonresidential new construction, interior lighting alterations, envelope insulation and cool roofs. This means that the evaluation applied the new construction factor for all new construction standards. In case the standard

The evaluation found above 100 percent rates and factors for Non-Residential New Construction with the majority of savings coming from interior lighting measures (80 percent), while envelope measures are

Table 15. Compliance Rates based on Energy Consumption Analysis

Category	Type	Energy Consumption 2008 Code	Energy Consumption As-Built	Compliance Rate
Nonresidential New Construction (91 sites)	kWh	22,847,342	19,886,535	115%
	kW	6,838	5,865	117%
	Therms	193,601	191,551	101%
Lighting Alterations (68 sites)	kWh	14,213,347	13,168,667	108%
	kW	4,627	4,322	107%

underperforming 2008 T24 requirements.[89] However, it was out of the scope of this study to investigate the reasons behind the underperformance/over performance of measures or if there were other factors influencing the findings. This type of investigation may be scoped in future evaluation plans in order to enhance our knowledge of driving factors.

Nevertheless, the efficiency gains from a modeled 2005 Title 24 compliant building to a modeled building with characteristics found in site audits was on average approximately 16 percent, whereas if they were to just meet 2005 and 2008 Title 24 requirements, modeled energy savings (kWh)for these buildings from 2005 to 2008 would be on average 3.6 percent. (Similarly, the original CEC 2008 standards potential study found that the kWh savings from 2005 to 2008 code were expected to be 4.9 percent.[90]).

Additional findings of the impact evaluation include:

- For Title 20 standards with advocacy between 2006 and 2009, the IOUs reached 94 percent of estimated electricity savings, with the majority of savings (70 percent) coming from Residential Pool Pumps Motors, Televisions and Portable Lighting Fixtures.
- The IOUs achieved 63 percent of Federal savings advocacy estimates with 98 percent of the savings coming from Electric Motors, Commercial Refrigeration and General Service Fluorescent Lamps. During 2010-2012, 9 Title 20 standards were preempted by 4 federal standards.
- 10 standards out of a total of 86 resulted in 60 percent of all the evaluated program net savings in the IOU territories.

Findings of the Best Practices Pilot process evaluation show that building departments found it challenging to dedicate time to the pilot; however, the pilot did provide tools that participants found useful in improving their processes. Significant challenges exist to quantitatively measure the impact of compliance improvement since baselines do not exist, building departments do not have the resources to adequately

89 This method of analysis focuses on modeling overall consumption, meaning that even if some measures did not prescriptively comply with requirements, others may over comply and compensate for losses.

90 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings (2007) available at http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PDF

track the data and data collection is very resource intensive, therefore this Pilot was scoped and implemented as a non-resource activity.

Recommendations

While many recommendations emerged from the evaluations conducted to date, several are critical to the continued progress of the program:

- Implementers should link program design and data tracking. This was a shortcoming for both the Compliance Enhancement and Reach Codes subprograms.
- The Compliance Enhancement subprogram should follow up on the results of the Best Practices Report to track long lasting improvement in practices.
- Implementers of the Reach Code subprogram should consider having participating jurisdictions collect data once a reach code is implemented in their jurisdiction to allow ongoing tracking of accomplishments and support impact assessment.
- The IOUs and CPUC staff should improve documentation and reporting requirements of savings estimates to support future impact evaluations.
- CPUC staff should document all methods developed during this and prior impact evaluations in one single document that could serve to inform future Codes and Standards impact evaluations.

For More Information

Findings from completed evaluation results can be found at www.calmac.org. These studies are listed below:

Completed Studies:

- 2010-2012 California Statewide Codes and Standards Program Process Evaluation Final Report http://www.calmac.org/publications/SCE-PG%26E_C%26S_Process_Evaluation_FINAL_5-28-12.pdf
- Codes and Standards Reach Code Subprogram 2010-2012 Process and Pilot Impact Evaluations http://www.calmac.org/publications/PY2010-2012_Reach_Code_Study_Published.pdf
- California Statewide Codes and Standards Compliance Enhancement Subprogram PY2010-2012 Pilot Process Evaluation http://www.calmac.org/publications/CEP-Report_FINAL_PUBLISHED.pdf
- Statewide Codes and Standards Program Impact Evaluation Report For Program Years 2010-2012 http://www.energydataweb.com/cpucFiles/pdaDocs/1163/CS%20Evaluation%20Report%20DRAFT%2008192014.pdf; Appendices: http://www.energydataweb.com/cpucFiles/pdaDocs/1164/CS%20Evaluation%20Report%20Appendices%20DRAFT%208192014.pdf

Other Resources:

Additionally, a list of Local Jurisdictions adopting reach codes is available at:

http://www.energy.ca.gov/title24/2008standards/ordinances/ .

The Codes and Standards Action Plan, which outlines key strategies to support the California Energy Efficiency Strategic Plan Codes and Standards chapter goals of pursuing more stringent codes and standards and improving compliance and enforcement. The plan is available at: http://www.cpuc.ca.gov/NR/rdonlyres/33894C3D-BAE7-4051-92A9-E066356FE820/0/CS_ActionPlan_20140219.pdf .

New Construction / Zero Net Energy Buildings

Overview

Commercial and residential new construction programs offer incentives, design assistance and training, and operate pilot projects to save energy and advance California's Zero Net Energy (ZNE) building goals adopted by the CPUC in the Strategic Plan. The ZNE goals for newly constructed buildings are that all new residential buildings and all new commercial buildings shall be zero net energy by 2020 and 2030 respectively. The new construction programs are operated by the IOUs' residential and commercial market sector teams, which coordinate closely with the Codes and Standards, Emerging Technologies and Workforce, Education and Training programs. The IOUs also operated separate ZNE and Sustainable Communities non-resource Pilot Programs in 2010-12, and completed two major studies on ZNE buildings in 2012.

Estimated Savings

The estimated savings for new construction and ZNE programs in 2010-2012 for residential and commercial buildings are included in the industrial and agriculture, commercial and residential chapters. The portion of these savings that resulted from programs dedicated to new construction are also presented in this chapter.

At the end of the 2010-2012 program cycle, the IOUs spent approximately $129 million on residential and

commercial new construction programs (approximately 5 percent of the portfolio). Evaluated gross energy savings were 215 GWh, 54 MW and 4.9 million therms, about half of which were directly attributable to the program interventions. These evaluated savings represent approximately 2.7 percent of total portfolio electric savings, 4.1 percent of demand savings and 2 percent of natural gas savings. Ninety five percent of evaluated new construction GWh savings come from the Savings By Design (Non-residential new construction);[91] the California Advanced Home Program (CAHP) saved 11 GWh, 12 MW and 1.7 million therms (gross).

simple energy efficiency and green building practices. It supplements these primary activities with feasibility studies, pilot projects, training and education, workshops, and program marketing.

Through a pay-for-performance incentive structure and a whole building approach, the residential California Advanced Home Program (CAHP) aims to increase market demand for energy efficient multifamily and single family homes by encouraging builders to exceed Title 24 building efficiency standards by 15 to 45 percent. In 2010-12, the program also offered performance bonus adders to encourage

Table 16. New Construction Sector Savings and Budget Snapshot

		New Construction						
		Expenditures	Energy Savings			Emissions	Cost Effectiveness	
		Million ($)	Electric (GWh)	Demand (MW)	Natural Gas (MM Therms)	CO_2 (Tons)	TRC	PAC
Reported	Gross	129	296	74	4.3	196	Residential: .40-.90	Residential: .39-.58
	Net		218	52	3.0	143	Commercial: 1.27 - 2.55	Commercial: 2.39-3.59
Evaluated	Gross		215	54	4.9	153	Residential: .40-.90	Residential: .39-.58
	Net		117	29	2.6	83	Commercial: 1.06 - 1.44	Commercial: 1.32 - 2.14
Percent Evaluated	Gross		95.0%	79.8%	61.3%			
	Net		96.1%	84.3%	67.2%			

New Construction/Zero Net Energy Programs

The non-residential building Savings By Design Program offers financial incentives to support integrated design for whole buildings, and encourages green building initiatives and compact homes, and technical designing and energy modeling assistance. An additional program promoted construction of new manufactured homes that comply with ENERGY STAR® standards.

PG&E's 2010-12 Zero Net Energy Pilot Project was a non-resource pilot that worked to advance

91 SBD savings include a small amount of savings from boilers and other upgrades to industrial and agricultural facilities.

California's ZNE goals in four ways: 1) A ZNE Communities activity that offered design and technical assistance to master-planned and advanced commercial and residential projects; 2) a ZNE Demonstration Project activity that supported monitoring and performance assessments and developed case studies; 3) a ZNE Technology Advancement activity that assessed integrated high –efficiency building systems level technologies; and, 4) a ZNE Design Integration activity that developed best practice information for design of ZNE buildings.

SCE and Sempra companies' Sustainable Communities non-resource pilots similarly offered design and technical assistance to master planned communities and ZNE buildings.

Highlights

The IOUs undertook significant activity in the new construction / ZNE area in 2010-12:

- The IOUs supported the construction of 16 Non-residential Zero Net Energy Buildings (verified or "emerging"), in 2010-12, providing technical, design and/or financial incentives. The majority of these were office or multi-family buildings. The IOUs also supported the construction of ten ZNE single family homes during the same period.[92]
- PG&E provided design, technical and financial consultations to 10 residential and commercial building projects. Six of these projects were completed during 2010-12, five of which have been monitored to measure actual performance. In 2014, PG&E published a "Zero Net Energy Case Study Buildings" monograph based on these projects, which is available online.[93] PG&E also completed four advanced ZNE technical studies and five technology assessments;[94] started commercial and residential ZNE building design training classes; and launched a ZNE architectural design competition during the 2010-12 period.[95]
- SCE's Sustainable Communities pilot project completed an "ABC" (Affordable, Buildable, Certified) Zero Net Energy Green Home in 2012, and offered tours of the home to thousands of visitors in 2012-13.[96] SCE completed two ZNE "emerging" buildings during 2010-12
- SCG completed a "Near ZNE Smart Gas" home in Downey to showcase the complementarity of gas and electric technologies in ZNE homes. SCG did not complete any ZNE non-residential buildings.
- SDG&E partnered with KB Homes to complete a Zero Net Energy production home, the "first of its kind", in the Rancho Santalina development in San Marcos, and completed two ZNE non-residential buildings (one verified, and one "emerging").

92 Data request response to Energy Division.

93 http://energydesignresources.com/resources/publications/case-studies/case-studies-zne-non-residential-buildings.aspx

94 "DC Distribution Market, Benefits and Opportunities, Residential and Commercial Buildings," (Ecova); "District-Scale Energy Systems Analysis for Zero Net Energy Communities," (Base Energy); "California Zero Net Energy Buildings Cost Study," (Davis Energy Group); "Net Energy Metering, Zero Net Energy and Distributed Energy Resource Future," (Rocky Mountain Institute).

95 Pacific Gas and Electric, 2010-2012 Energy Efficiency Portfolio, Program Year 2012 Pilot Program Target Updates, June, 2013.

96 Heat Pump Water Heater; Evaporative Condenser; Ground Coupled Heat Pump; Electrochromic Windows; Energy Recovery Ventilators.

Findings

The *PG&E Zero Net Energy Pilot Project* building studies included findings relevant to the new construction building sector, and to California energy agencies. Key findings of *The Road to ZNE: Mapping Pathways to ZNE Buildings in California* and *The Technical Feasibility of Zero Net Energy Buildings in California*[97] include:

- The goals are aggressive, requiring vigilance in nearly all aspects of equipment engineering, building design, construction, and building operations; however, ZNE buildings will be technically feasible for most of California's new construction market in 2020.[98]
- Deep energy efficiency should be the foundation of ZNE buildings, with a "loading order" or steps to achieve ZNE buildings.
- Specific Energy Use Intensity (EUI) targets should be established for various building types and by climate zone to establish a common reference point.
- Systems and design strategies likely to create the big system efficiency gains necessary to reach ZNE goals include:
  - Load Reductions;
  - Passive systems such as natural ventilation, for which California is well suited;
  - Active systems like moving residential ducts out of unconditioned attics and heat recovery;
  - Renewable energy like including parking lot photovoltaics as part of ZNE buildings.[99]
- California's ZNE building 2020 and 2030 goals will help the state achieve its greenhouse gas reduction goals.

SCE's *Savings By Design Market Potentials, Characterization and Best Practices Enhanced Participation Study* offered insight into the building types and counties where energy savings opportunities reside in the non-residential new construction and 'to-the-studs' renovation market. The CPUC's *Custom Impact WO033 Evaluation Report, 2010-2012. Appendix F; New Construction Programs and Projects* identified priorities for program oversight to ensure accurate savings estimates. Key findings from both studies included:

- From 2008 to 2012, the renovation sector was the highest grossing sector of the California non-residential "new" construction market. Current economic conditions have increased major renovations of existing facilities as an alternative to new construction – frequently repositioning them for different industry use (e.g., big box retail stores being renovated as healthcare facilities).
- Table 17 indicates the percentage of square footage completed by the Savings By Design program by year and by utility as compared to the total construction market. Limited market penetration indicates that the non-residential Savings By Design Program could increase penetration in all markets. Highest potential

97 See The Road to ZNE: Mapping Pathways to ZNE Buildings in California, December 2012, at http://calmac.org/publications/The%5FRoad%5Fto%5FZNE%5FReport%5FCALMAC%5FPGE0327%2E01%2Epdf

98 Hospitals and large hotels are the most challenging buildings to achieve ZNE. These building types are estimated to comprise less than 3% of the projected California 2020 construction volume.

99 Three building types that did not fully reach ZNE by 2020 –multi-family high rise, large offices, and sit down restaurants -- might accomplish this by using parking lot PV systems.

building types include: Office and Banks, Stores, Restaurants, Manufacturing Plants, Warehouses, Labs, Schools, and Libraries.
- The Savings By Design program achieved about 51 percent of expected natural gas savings and 81 percent of electric savings as a result of the use of inappropriate modeling assumptions operating considerations, calculation methods and baselines.
- This market is concentrated among a relatively small number of builders. From 2010-12, five percent of builders accounted for 33 percent of all units and 20 percent built two-thirds of all units. Construction starts increased from 16,336 to 22,753 units between 2010 and 2012 and permit data suggests a trend toward higher proportions of multi-family units.
- IOU program participants accounted for 38 percent of multi-family units started from 2010-12. But there is substantial overlap between the IOUs' program participants and those affected by other programs and policies: 53 percent of IOU program units that were started from 2010-12 were required to be high efficiency because they were located in a reach code locality or received a California affordable housing tax credit.[100]
- Nearly all affordable housing (38 percent of all multi-family units started from 2010-12), is built to exceed Title 24 standards by 15 percent because of California tax credit requirements. Fifty-seven percent of Californian multi-family units started from 2010-12 were

Table 17 Savings By Design Participation Rate by Year for All Building Types

	2006	2007	2008	2009	2010	2011	2012
PG&E Participation Rate	11%	15%	13%	34%	15%	6%	3%
SDG&E Participation Rate	6%	16%	16%	12%	26%	5%	41%
SCE Participation Rate	14%	12%	14%	15%	16%	12%	9%

Source: Navigant Analysis
Savings By Design Market Potentials, Characterization and Best Practices Enhanced Participation Study, p. 2.
www.calmac.org Study ID: SCE0357.01

- Modeling issues included use of Title 24 rather than-as designed operating schedules and models not updated to reflect "as built" conditions and low occupancy rates. Non-modelings issues included use of inappropriate baselines and higher than expected I.T. loads for data centers.

The CPUC's *Final Phase I Report: Baseline Characterization- Market Effects of Investor-Owned Utility Multifamily Residential New Construction Programs in California* characterized current market conditions for California's multifamily new construction market. Key findings for the multi-family new construction market included:

100 Program administered by the California Tax Credit Allocation Committee (CTCAC).

subject to above-code requirements either because of requirements of low-income funding or their location in a reach code locality.
- Multi-family starts were concentrated in major cities and urban areas. Forty-six percent of all starts (by units) and 66 percent of high-rise units were in five cities- Los Angeles, San Jose, San Francisco, San Diego, and Irvine.

PG&E's *Residential New Construction Measure Optimization Tool Update* study assessed incremental costs to build single family homes that exceeded 2008 Title 24 standards by 20-40 percent. SCE's Market Research on *Builder's Selling Practices and Strategies for Energy Efficiency Homes* assessed marketing best practices and developed tools to help CAHP builders increase sales of efficient homes. Key findings included[101]:

- Energy consumption can be reduced 39-62 percent compared to code with commonly available energy efficiency measures for single family homes.
- Incremental costs for above-code single family homes ranged from $500 to $5,000 (for homes 20 and 40 percent greater than Title 24 [2008] respectively).
- Sales training is a key component of overall California Advanced Home Program program design and should be combined with building science training, market supporting and long-term relationship building, to ensure that the program's overall success in penetrating the new homes market.

Recommendations

Achieving California's ZNE building goals will require coordinated approaches from all parties to ensure that all energy efficiency, demand response and renewables policies are aligned with the goals. New construction and ZNE building studies undertaken in 2010-12 reached many recommendations.

Recommendations from *"The Road to ZNE"*[102] *and The Technical Feasibility of ZNE Buildings in California*[103] include:

- Develop requirements for "ZNE Ready" or "ZNE Capable" buildings that meet the same stringent EUIs as a ZNE building, but that may or may not include onsite renewables.
- Evaluate and mitigate the grid impacts of ZNE buildings.
- Internalize ZNE goals in IOU energy efficiency portfolio planning and define a Codes and Standards path to ZNE.
- Expand training efforts in the area of integrated design and construction.
- Conduct further research in priority areas including:
  - Investigating costing and cost-effectiveness analyses of measures and strategies

101 See Market Research on Builders' Selling Practices and Strategies for Energy Efficient Homes, May 2013, at http://www.calmac.org/publications/MARKET%5FRESEARCH%5FON%5FBUILDERS%5FSELLING%5FPRACTICES%5FAND%5FSTRATEGIES%5FFOR%5FENERGY%5FEFFICIENT%5FHOMES%5FSCE033501%2Epdf

102 See The Road to ZNE: Mapping Pathways to ZNE Buildings in California, December 2012, at http://calmac.org/publications/The%5FRoad%5Fto%5FZNE%5FReport%5FCALMAC%5FPGE0327%2E01%2Epdf

103 See The Technical Feasibility of Zero Net Energy Buildings in California, December 2012, at http://calmac.org/publications/California%5FZNE%5FTechnical%5FFeasibility%5FReport%5FCALMAC%5FPGE0326%2E01%2Epdf

included in the study's exemplar ZNE building designs;
- Improve assessment of policy impacts on PV generation capacity requirements, using a sampling of residential and commercial building load profiles;
- Assess the grid management challenges and cost of service implications from high levels of PV integration.

Recommendations from SCE's *Savings By Design Market Potentials, Characterization and Best Practices Enhanced Participation Study* and the CPUC's *Custom Impact Evaluation Final Report, 2010-2012*[104] included:

- Savings By Design has focused on large buildings with long design periods and relatively generous design budgets. To fully penetrate the identified market potential, SBD needs to have a more flexible program process that can mimic the design process and pace of other design approaches that have accelerated design timelines and short decision windows.
- Savings By Design should be fully prepared to take advantage of opportunities in the remodeling/repositioning/ creative reuse area of existing building renovation and should focus on a few of the largest commercial markets (target markets) to engage with and generate most of the additional savings.
- Savings By Design should put increased attention into award/recognition programs, efforts such as Architecture at Zero, working with efficiency or green rating systems, and opportunities such as trade shows and events.
- IOUs should: provide technical outreach assistance to all program participants; use "as-built" schedules to update ex-ante savings estimates; and submit a Title 24 acceptance test report, perform site visits to verify key measures and revise energy models to "as-built" conditions.

Recommendations from the CPUC's *Final Phase I Report: Baseline Characterization- Market Effects of Investor-Owned Utility Multifamily Residential New Construction Programs in California* include:

- IOUs should benchmark the performance of IOU multi-family new construction program participants. Benchmarking can help make the case for efficiency to financial institutions and secondary investor markets, increasing access to capital for high-efficiency projects, as well as to consumers who often cannot compare utility costs between units and builders who may be skeptical of building performance.
- The IOUs' programs should attempt to target the largest builders since the market is highly concentrated among a small number of builders, particularly for market-rate projects.
- IOU programs should coordinate with voluntary programs such as California Tax Credit Allocations Committee, LEED, Green Point Rated (GPR) and ENERGY STAR® to provide consistent efficiency standards and to leverage the brand recognition and brand equity of other voluntary programs.

104 See Custom Impact Evaluation Final Report Appendices (Appendix F on Savings By Design). http://www.energydataweb.com/cpuc/

Recommendations from SCE's *Market Research on Builder's Selling Practices* study that the IOUs should consider include the following[105]:

- Develop a builder sales training module that uses adult learning principles, multiple training formats, and translates building science "features" into "benefits".
- Offer sales training as a benefit of California Advanced Home Program participation, and consider expanding the sales training audience to include appraisers, lenders and others in the realty industry.
- Consider conducting a long-term statewide consumer marketing campaign to stimulate market demand for efficient California Advanced Home Program homes.

For More Information:

Findings from the studies included in this chapter may be found at www.calmac.org and http://www.energydataweb.com/cpuc/. Please also review related results in the Codes and Standards chapter of this report. These studies are listed below:

Completed Studies:

- The Technical Feasibility of Zero Net Energy Buildings in California
- The Road to ZNE: Mapping Pathways to ZNE Buildings in California
- Residential New Construction Measure Optimization Tool Update
- Market Research on Builder's Selling Practices and Strategies for Energy Efficiency Homes
- Savings By Design Market Potentials, Characterization and Best Practices Enhanced Participation Study
- Final Phase I Report: Baseline Characterization- Market Effects Study of Investor-Owned Utility Multifamily Residential New Construction Programs in California.
- Custom Impact WO033 Evaluation Plan, 2010-2012. Appendix F. New Construction Programs and Projects

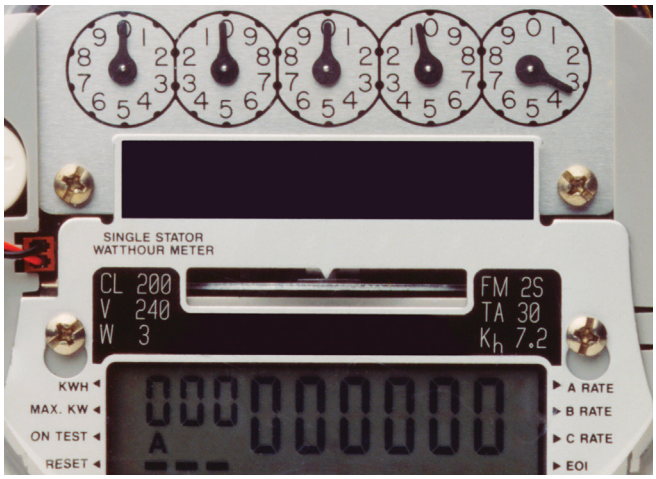
Other Resources:

PG&E's **Zero Net Energy Building Pilot Program** is described here: http://www.pge.com/mybusiness/energysavingsrebates/rebatesincentives/znepilotprogram/

SCE's **Zero Net Energy Building Blog** may be found here: http://zeronetenergy.blogspot.com/

105 See Market Research on Builders' Selling Practices and Strategies for Energy Efficient Homes, May 2013, at http://www.calmac.org/publications/MARKET%5FRESEARCH%5FON%5FBUILDERS%5FSELLING%5FPRACTICES%5FAND%5FSTRATEGIES%5FFOR%5FENERGY%5FEFFICIENT%5FHOMES%5FSCE033501%2Epdf

Integrated Demand Side Management



Overview

The 2010-2012 energy efficiency program cycle guidance decision identified integrated demand side management (IDSM) as a pilot strategic plan program. Historically, demand-side programs have been "siloed," focusing on individual technologies such as a single efficient air conditioner, an efficient lamp, building envelope improvements, distributed generation, AC cycling, or some combination of these.

The current energy efficiency portfolio program structure largely reflects the history of California's appliance-based conservation efforts that began with state and federal legislation in the early to mid-1970s.[106] Because of this, energy efficiency measures are the primary focus for the programs. As these efforts broadened over time to include more measures and all customer types, IDSM can be seen as a further evolution of this historical trend to provide tractable demand side management opportunities for IOU customers and municipalities by identifying and promoting opportunities to improve customers' energy management for all demand side energy management technologies (energy efficiency, distributed generation, and demand response). These

106 See Retrospective Examination of Demand-Side Energy Efficiency Policies by Kenneth Gillingham, Richard Newell, and Karen Palmer. (http://www.rff.org/Documents/RFF-DP-04-19rev.pdf) The passage of the first energy appliance legislation, the 1974 California Warren-Alquist Energy Resources Conservation and Development Act, establishing the California Energy Commission with the authority to set appliance standards. This led to federal standards and eventually to full-fledged DSM programs.

opportunities include energy efficiency, demand response (reducing demand at critical times or in response to electricity prices), and on-site customer electric generation and coordination with smart meter program efforts. While still early in its development, IDSM may ultimately be an important tool in ensuring California's ability to meet energy needs while reducing per capita energy use and moving towards zero net energy (ZNE) buildings.[107]

IDSM is classified as a non-resource program, and therefore no energy savings are reported for this program. The IOUs spent approximately $28.3 million (approximately 1 percent of total portfolio expenditures) on IDSM activities in 2010-2012. IDSM activities are performed both directly within the statewide IDSM program and through individual utility- / sector-specific programs. Approximately $4 million were spent on the statewide IDSM program activity, and approximately $21 million were spent on program-specific integrated projects, integrated audits and other statewide programs such as Zero Net Energy, core market sector programs (e.g. commercial, residential), and pilot programs.

IDSM Programs

There were 14 pilot programs within the statewide IDSM effort in the 2010-2012 cycle. These included PG&E's Green Communities Program, SCE's and Sempra's Sustainable Communities Program, and SDG&E's Micro Grid Pilot, and featured integrated demand-side marketing, administration, funding and customer incentives, training, delivery, and evaluation to facilitate a more streamlined delivery. This integrated approach was designed to achieve the greatest possible energy savings throughout the portfolio, while minimizing redundancies and missed opportunities. Additionally, to address specific barriers to effective implementation of IDSM, the IOUs were directed to develop several outputs: a method to measure cost-effectiveness of integrated projects and pilots; measurement and evaluation protocols for IDSM projects and programs; standardized integrated audit tools; and, an IDSM Task Force over the course of the 2010-2012 cycle.

Highlights

The IOUs have improved the integration of the project applications and reimbursement process for some projects, which is intended to create a more concise and streamlined process for customers. Additionally, the IOUs have developed an online integrated assessment tool targeting small business and residential customers.[108] Finally, the IOUs have developed a unified project inspection process, which is also intended to eliminate unnecessary redundancies and streamline the inspection process.

In addition, during the 2010 – 2012 cycle PG&E and SCE internally reorganized to help promote and support delivery of integrated demand-side strategies

107 See California's Energy Action Plan at http://www.cpuc.ca.gov/PUC/energy/resources/Energy+Action+Plan/ and California's Energy Efficiency Strategic Plan at http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp/

108 See SCE's Business Energy Advisor at www.sce.com/wps/portal/home/business/tools/business-energy-advisors and the Home Energy Advisory at www.sce.com/homeenergyadvisor; PG&E's Residential tool is found at http://www.pge.com/en/myhome/saveenergymoney/analyzer/index.page and the Non-Residential tool is at www.pge.com/audit; SoCalGas's Business tool is found at http://socalgas.com/for-your-business/energy-survey/index.shtml and the Residential tool is found at http://socalgas.com/for-your-home/energy-savings/ways-to-save.shtml; SDG&E's tool is found at https://myaccount.sdge.com/myAccount/myAccount.portal?_nfpb=true&_pageLabel=savings_tools_page

by assigning staff and internal responsibilities across IDSM implementation and sharing oversight for energy efficiency, demand response, and distributed generation. As a result, personnel are now more aware of the objective to provide integrated solutions to customers, which improves customer integration. While these IOUs have attempted to restructure their internal staff to support integration of demand side technologies, existing barriers and challenging have affected the success of these efforts as the IOUs continue to address how their internal operations can support IDSM as a statewide strategic planning effort. Some of these barriers stem from siloed CPUC proceedings and funding streams.

Findings

Key findings have been derived from evaluation studies, interactions with and reports from the IDSM Task Force, and DSM awareness questions in a survey of the commercial sector[109]. Preliminary findings from the IDSM Omnibus Process Evaluation were included in the 2012 report and final results inform findings presented here, as well. The Commercial Saturation Survey (CSS) was completed in July of 2014 and collected information on a variety of energy efficiency, demand response, and photo-voltaic and distributed generation systems in the commercial sector. This effort represents the first time significant data was collected for all demand side measures at the customer site. Large sites, retail stores and colleges have the highest level of distributed generation participation with 23.9 percent of retail sites and 23.1 percent of college sites participating in programs. Medium sized schools have a participation rate of 18.7 percent. The business types most likely to participate in all three demand side measures are colleges (2.1 percent), schools (1.77 percent), and hospitals (0.53 percent). Food and liquor stores and industrial business represent segments with relatively high levels of energy efficiency and demand response participation but lower distributed generation participation. For all IOUs, larger business customers are more likely to participate in both energy efficiency and distributed generation than medium, small, and very small customers. Overall there is a very low share of consumption and sites participating in both energy efficiency and distributed generation measures illustrating that much is left to be achieved to integrate energy efficiency and distributed generation. [110]

The sources cited above have revealed several challenges as the IDSM approach continues to evolve:

- The CPUC's historically siloed proceedings and funding streams represent a significant barrier to developing integrated pilot programs that support all demand side technologies. Therefore more direction and guidance is needed from the CPUC specific to implementing and funding integrated energy programs.
- Funding and regulatory silos across DSM programs creates barriers and challenges for IDSM related program design and implementation.
- A cost-effectiveness methodology that supports effective evaluation, design and implementation of IDSM strategies and programs has not yet been developed and adopted.
- A consistent and widely accepted definition of IDSM within the IOUs is still lacking (for

109 Preliminary Commercial Saturation Survey and Market Share Tracking Findings, Itron, Inc., June 2013

110 "The California Commercial Saturation Survey", p. ES-24. Itron, Inc., July 2014

example, marketing appears to largely focus on efficiency and demand response, and does not have a consistent approach for distributed generation content).

- Progress toward integration is limited by the lack of a unified and consistent integrated tracking database that includes rebated energy efficiency, audit, demand response, distributed generation, and a dearth of web-based smart grid programs.
- Preliminary findings from the Commercial Saturation Survey indicates that large companies are receiving more information on demand response than medium and small companies, while medium and small companies know more about distributed generation than their large counterparts.[111]

Recommendations

The 2010 – 2012 IDSM Omnibus Evaluation[112] included the following recommendations to improve IDSM implementation based on input from the IDSM task force:

- Expand breadth of participation in the IDSM Task Force to include representatives beyond the utilities and CPUC.
- Improve data tracking and collection for integrated programs and projects.
- Develop and implement a consistent integrated marketing plan that incorporates energy efficiency, demand response, distributed generation, and SmartMeter-enabled programs and strategies.
- Restructure current IDSM pilot programs to increase support for IDSM goals and objectives to further promote integration.
- Research why distributed generation is not being promoted through IDSM activities, and implement strategies to include distributed generation more significantly in IDSM (including understanding distributed generation potential).
- Develop an integrated cost-effectiveness methodology to support IDSM based on a common "core" of avoided cost inputs and methods combined with resource-specific variations, as appropriate and taking into account interactive effects between energy efficiency, demand response, and distributed generation.
- Seek to synchronize CPUC proceedings for demand response, energy efficiency, and distributed generation so they begin and end around the same time to deal with integrated components consistently and simultaneously.

For More Information

Findings from the 2010 – 2012 CPUC Omnibus IDSM Process Evaluation may be found at http://www.energydataweb.com/cpucFiles/pdaDocs/889/CPUC_IDSM_FinalReport.pdf

The California Commercial Saturation Survey: http://www.energydataweb.com/cpucFiles/pdaDocs/1160/California%20Commercial%20Saturation%20Study_Appendices_Final.pdf

111 Itron, Preliminary Memorandum: Attitude and Awareness of DSM and IDSM in the Commercial Population, May, 2012

112 See Energy Division's 2010-2012 CPUC Omnibus IDSM Process Evaluation Early Feedback Memo, February 2012; and D.12-05-015 at http://docs.cpuc.ca.gov/WORD_PDF/FINAL_DECISION/166830.PDF

Workforce Education and Training

Overview

Workforce Education and Training (WE&T) plays a key role in achieving California's ambitious energy efficiency goals. As noted in the Strategic Plan, "in order to accommodate the dramatic increase in energy efficiency activities envisioned by this Plan and required by AB 32, California must develop a trained workforce, including people qualified in energy-efficiency engineering, construction, maintenance, program design and implementation, and financial analysis."[112] The CPUC and the IOUs have taken steps to strengthen existing and, where needed, promote new coordinated workforce training efforts specific to energy-related sectors. With the strong emphasis in recent years on establishing the proper labor force for the "new economy," the 2010–2012 program cycle marked the first time that the CPUC provided guidance to the IOUs regarding Workforce Education and Training activities.

The Statewide Workforce Education and Training Program is currently considered a "non-resource program," and therefore no energy savings are reported for this program. Non-energy benefits associated with the Workforce Education and Training program include higher quality installations (potentially resulting in more energy savings), higher quality jobs due to increased skillsets[113], and increased market penetration of renewables and energy efficiency due to a fully

112 See Strategic Plan at http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp/

113 "Job quality standards include living wages or other wage standards, health and other benefits", California Workforce Education and Training Needs Assessment for Energy Efficiency,

trained workforce able to support these technologies. In 2010-2012, the IOUs spent $84 million on statewide Workforce Education and Training activities. The Workforce Education and Training activities make up approximately three percent of the total portfolio budget.

The Statewide Workforce Education and Training Program tracks program performance metrics to gauge progress towards meeting program goals. One such metric is the number of participating schools that serve primarily minority and low-income populations. As of the end of the 2010-2012 program cycle the K-12 Connections program, which promotes career awareness and energy efficiency, had 1,462 participating K-12 schools. [114] Of those schools, 65 percent were Title 1 schools (one criteria used to identify low income populations), thus exceeding its goal of 50 percent.[115] Southern California Gas Company had the largest percentage of Title 1 school participation, representing 72 percent of their participating schools. A second tracked metric is the number of classes or trainings that offer integrated content (incorporating multiple DSM topics, such as energy efficiency, demand response, and distributed generation). For example, IOU energy centers in California hosted more than 300 trainings that offered integrated demand side management content.[116]

Workforce Education and Training Programs

The IOUs' statewide Workforce Education and Training efforts seek to build workforce readiness through sector strategy partnerships and education, and three specific sub-programs: Centergies, Connections, and Strategic Planning.

The Centergies sub-program organizes training around technology categories (i.e. advanced lighting and HVAC) and focuses on facilitating education and training in energy efficiency and integrated demand side management (IDSM). Centergies also promotes facility energy management training with labor markets, organizations, and other educational institutions. The sub-program's primary delivery mechanism is through the IOUs' statewide energy centers. Depending on the IOU, an energy center may offer anywhere between 30 and 300 unique courses throughout a year. The IOUs continued to collaborate with organizations and offer certification programs statewide. These include, but are not limited to:

- Building Operator Certification (BOC).
- North American Training Excellence (NATE).
- California Advanced Lighting & Controls Training Program (CALCTP).
- Home Energy Raters Training (ResNET, CalCerts, CHEERS).
- American Institute of Architects (local chapters and statewide through AIA California Council).
- US Green Building Council.
- Institute of Heating & Air Conditioning Industries (IHACI).

Distributed Generation, and Demand Response, Don Vial Center on Employment in the Green Economy, p. 110, March 2011.

114 See Joint IOU Program Performance Metrics Report for Program Year 2012, available at www.eestats.cpuc.ca.gov .

115 Title 1 schools are defined as schools in which at least 40% of the students are enrolled in the Free and Reduced Lunch Program.

116 See Workforce Education & Training Phase 2 Process Evaluation: Centergies, Opinion Dynamics Corporation, December 2012, at http://calmac.org/publications/2010-2012_WE%26T_Centergies_Process_Eval_Report_volume_1.pdf .

The Connections sub-program focuses on building collaborations with external educational institutions to promote coordinated energy related careers and training activities with primary educational level institutions such as K – 12 and the California Partnership Academies as well as secondary adult educational level institutions such as community colleges, community based organizations, trade organizations, and universities.

The Strategic Planning sub-program utilizes a statewide task force (including the IOUs and external stakeholders) to address broader Workforce Education and Training implementation and partnership strategies.

Highlights

Through the IOUs' Centergies sub-program and other activities, training has reached plumbers, lighting contractors, HVAC installers, and other key labor specialties. The California Advanced Lighting Controls Training Program (CALCTP), originally conceived and supported by Southern California Edison, is focused on increased installation and use of advanced lighting controls, and training and certifying electricians in the proper design, installation and commissioning of advanced lighting control systems.

This program has been heralded as one of the most successful training and certification efforts in the 2010-2012 cycle and is being used as a model for the IOUs to develop similar sector strategy approaches in the 2013-2014 cycle. In addition:

- From 2009 to 2011, Centergies' energy centers have hosted over 500 education and training classes focused in multiple aspects of demand side energy services.[117]
- The Connections sub-program promotes career awareness and, since 2011, has fostered an increase in educational collaborations with organizations serving disadvantaged communities (one of several metrics tracked).
- As noted earlier in 2012[118], the K-12 educational level had 1,462 participating schools, 65 percent of them were Title 1 schools.[119]
- PG&E's efforts resulted in the largest increase in these collaborations, working with 22 additional schools; a 105 percent increase since 2011.
- With respect to post-high school continuing education outreach partnerships, PG&E has supported the largest number among the IOUs with 26, including the 360 Green Careers online course for high school students. [120]

The California Energy Efficiency Strategic Plan identified as a high priority strategy a statewide needs assessment that examines workforce training needs in the areas of energy efficiency, distributed generation, and demand response. Consequently, CPUC Decision 09-09-047 directed the investor owned utilities to perform this statewide needs assessment.

117 See Workforce Education & Training Phase 2 Process Evaluation: Centergies, December 2012, Opinion Dynamics Corporation, at http://calmac.org/publications/CA_CEI_Pilot_Evaluability_Assessment_REVISED_FINAL.pdf .

118 Joint IOU Annual Program Performance Metrics Report for Program Year 2012.

119 Title 1 schools are defined as schools in which at least 40% of the students are enrolled in the Free and Reduced Lunch Program.

120 See Resolution E-4385, which established program performance metrics (PPMs) for statewide energy efficiency programs, at http://docs.cpuc.ca.gov/word_pdf/FINAL_RESOLUTION/127632.pdf

The development of this needs assessment was performed by UC Berkeley's Don Vial Center on Employment in the Green Economy and co-managed by Southern California Edison and the CPUC. In March of 2011 the workforce needs assessment was published.

Findings

Several 2010-2012 Workforce Education and Training program cycle studies have been completed. The Workforce Education and Training Process Evaluation (Volume I: Centergies, and Volume II: Connections) assessed how well the Workforce Education and Training sub-programs were aligned with the Strategic Plan and the recommendations of the 2011 Workforce Education and Training Needs Assessment.[121] These studies also looked at whether the sub-programs met the needs of target markets pertinent to energy efficiency related training. Key findings from these evaluations include:

- Energy Centers are primary delivery channels for education and influencing services in the energy efficiency marketplace that support the goals of the California Strategic Plan.
- Over the past three years, depending on the size and location of the Energy Centers, 600 to 11,000 unique workers attended courses at each center.
- Evidence suggests these courses contribute to workforce outcomes (such as career advancement) with 81 percent of course participants reporting the courses improve their job performance.
- Approximately 83 percent of participants believed that the courses contributed to career related benefits.
- There is significant interest in new course offerings in the areas of integrated building systems, building sciences, sustainable buildings, and classes pertinent to the food service sector in the areas of codes and standards, sub-metering, and onsite generation.
- Energy Center staff support the Needs Assessment goals and recommendations to better serve the market's training needs but due to limited resources believe they must partner and collaborate with other entities to fulfill this role.[122]

Several findings emerged from the evaluation of the Connections subprogram activities including:

- Approximately 60 percent of the schools or districts touched by the program had not previously provided education on energy efficiency or conservation.
- Approximately 45 percent of teachers had not previously taught their students about energy efficiency or conservation.
- More than 70 percent of educators strongly believed that students are learning about ways to save energy through the program.
- High school and community college students were underserved in the 2010-2012 Connections sub-program (this finding has prompted the IOUs to develop new and

121 See California Workforce Education and Training Needs Assessment for Energy Efficiency, Distributed Generation, and Demand Response, Donald Vial Center on Employment in the Green Economy, UC Berkeley, March 2011, p. 9. http://www.irle.berkeley.edu/vial/publications/ca_workforce_needs_assessment.html

122 ibid.

update existing programs for the 2013-2014 program cycle).

Recommendations

Based on the 2010 – 2012 Workforce Education and Training Process Evaluation of Centergies and Connections, the following recommendations for program improvement are currently under consideration:

- Broad utility engagement in developing workforce and economic sector strategy initiatives as described in the California Workforce Education Needs Assessment.[123]
- Targeted sector strategy initiatives supporting high school and community college curriculum and training program development, including linkages to independent job placement programs.
- Targeted high school and community college bridge programs with some emphasis on high schools in underserved communities.
- Promotion of K-12 career awareness and embedding energy efficiency concepts into standard curriculum across the state at all levels of education.

The Workforce Education and Training Needs Assessment produced the following recommendations for California's Investor Owned Utilities:

- Initiate, help fund, and partner with other organizations to develop robust sector strategies in key energy efficiency sectors.
- Modify the structure of classes offered by the Energy Training Centers to increase the number of course series that are longer in length than current typical classes.
- Expand collaborations between the Energy Training Centers and building and construction trades associations.
- Actively participate in the content development, review, and updating of curricula, and support instructor professional development for the main "home institutions" that train building and construction professionals and trades people.
- Adopt as a goal for the Energy Training Centers the inclusion of low-income, minority, and disadvantaged workers and job seekers.
- Assess and determine what additional information is required to evaluate workforce outcomes for the Energy Training Centers.
- Increase the emphasis on career awareness and career exploration in ratepayer-funded education programs serving K-8 students.
- Work with education agencies, schools, and funding partners to allow for the collection and reporting of demographic information on students participating in ratepayer-funded Connections education programs.

For More Information

Findings from evaluation results included in this chapter and studies related to Workforce Education and Training efforts may be found at www.calmac.org and www.energydataweb.com/cpuc. These studies are listed below. Progress on work done to address 2010 – 2012 Workforce Education and Training Process Evaluation recommendations, directives, and

123 California Workforce Education and Training Needs Assessment for Energy Efficiency, Distributed Generation, and Demand Response, Donald Vial Center on Employment in the Green Economy, UC Berkeley, March 2011, p. 204.

the Needs Assessment can be found in the 2012 Joint IOU Workforce Education & Training Annual Report.

Completed Studies:

- *Workforce Education & Training Process Evaluation, Volume I: Centergies*
- *Workforce Education & Training Process Evaluation, Volume II: Connections*
- *Workforce Education & Training Needs Assessment*
- 2010-2012 Building Operator Certification (BOC) Impact Evaluation

Marketing, Education, and Outreach

Overview

Marketing, Education and Outreach (ME&O) are critical for the success of energy efficiency and other demand side programs. Because many programs are voluntary in nature, consumer actions may range from switching a light bulb to more complex participation, such as investing thousands of dollars in a whole-building upgrade. To this end, ME&O establishes the foundation for energy management by increasing consumers' understanding of its key benefits and encouraging them to engage in varying degrees of actions.

Because participation in energy savings programs spans across a variety of motivators and drivers, like home comfort or taking action for a better environment, the messages and approaches appropriate for different sectors will vary for different customers as well as different programs and services. According to a paper published in 2013 by the Policy and Planning Division of the CPUC, the growth in demand side programs is creating a paradigm shift wherein energy consumers have options that make them active participants in the power grid rather than passive recipients of energy.[124] This change has the potential to create a relationship between the IOUs and customers that is more like a partnership than it has historically been. Program marketing will thus become increasingly important in order for California to meet its clean energy and climate reduction goals.

124 See Customers as Grid Participants: A Fundamentally New Role for Customers, CPUC Policy and Planning Division, May 2013, http://www.cpuc.ca.gov/NR/rdonlyres/A0A816A2-9F1C-4F34-90DB-C23551F09738/0/PPDCustomerRoleMay15th.pdf .

Marketing Education and Outreach Programs

The CPUC responded to the challenge of increasing customer participation in energy saving programs by taking a new approach to statewide ME&O. In May 2012, the Commission voted to expand the existing Energy Upgrade California brand from its original focus on whole-house retrofits and make it an umbrella marketing, education and outreach platform for all demand side programs. As part of this new approach, the Commission named an independent nonprofit organization, the Center for Sustainable Energy (CSE), to transition the expanded Energy Upgrade California statewide ME&O program.[125] Energy Division staff, the IOUs and other stakeholders are working collaboratively on the transition. The Commission is currently considering the IOUs' applications and a new marketing plan and associated budget proposal by CSE.[126]

There are two main categories of ME&O programmatic activity:

- The statewide ME&O campaign, Energy Upgrade California, is a non-resource program with a proposed budget of $57.9 million which will be managed by CSE with PG&E serving as the contract administrator on behalf of the IOUs.
- The "local" marketing efforts of the many IOU programs. The local marketing program

Table 18. 2010-2012 Statewide Non-Resource Program Expenditures – Marketing, Education and Outreach

Sector	Non-Resource Programs	Resource Programs
Industrial and Agriculture	$708,591	$13,607,486
Codes and Standards	n/a	$470
Commercial	$3,344,114	$29,219,657
HVAC	$41,401	$4,159,406
Lighting	n/a	$6,681,398
IDSM	$9,292,845	
Government Partnerships	$3,619,440	$6,257,890
Statewide ME&O (Transition activities)	$17,393,615	
Residential	$2,527,210	$40,560,022
WE&T	n/a	$383,457
Total	$36,927,214	$100,869,786

125 D.12-05-015. Available at http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/166830.PDF .

126 The draft "Energy Upgrade California" marketing plan is available at: http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Statewide+Marketing.htm

budgets are included in individual program budgets. The ME&O line item for each of the program areas are broken out below for the 2010-2012 cycle, followed by highlights for both statewide and local marketing.

Table 19. 2010-2012 Statewide Non-Resource Program Expenditures – ME&O

Sector	Non-Resource Programs	Resource Programs
Industrial and Agriculture	$708,591	$13,607,486
Codes and Standards	n/a	$470
Commercial	$3,344,114	$29,219,657
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Statewide ME&O (Transition activities)	$17,393,615	
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WE&T	n/a	$383,457
Total	$36,927,214	$100,869,786

Highlights

The CPUC's May 2012 Energy Efficiency Guidance decision called for a major rebranding effort as well as a new strategic approach.[127] This included an examination of lessons learned from prior program cycles including the *Flex Your Power* and *Engage 360* campaigns. Unspent funds from the previous statewide campaign have supported the following transition activities:

- The Energy Upgrade California brand has expanded to encompass statewide ME&O efforts for all demand side activities going forward. Transition funds have supported CSE's work to develop brand guidelines, hold monthly planning meetings with stakeholders, assess the Energy Upgrade California brand, and other activities.
- In 2014, the new Energy Upgrade California website, www.EnergyUpgradeCA.org, was launched. It is now a "one-stop shop" which had content on all of the measures Californians can take, as well as educational language about California's energy and climate policies. The new site also retains the ability for consumers to find a Home Upgrade contractor.
- CSE, in partnership with local implementers, took Energy Upgrade California on tour in November 2012 sharing educational displays about the benefits of home upgrades at Green Building conferences and schools. The tour was funded by the Department of

127 See D. 12-05-015 at http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/166830.PDF .

Energy's "Better Buildings Neighborhood" program.

- Through a collaborative process that included a variety of stakeholders, CSE produced a marketing plan for the Energy Upgrade California campaign which was approved by the CPUC in early 2014. The marketing plan provides details on program design, target audiences, proposed metrics, and other components of the upcoming Energy Upgrade California campaign.

Findings

As part of Energy Upgrade California transition activities, in 2013 CSE commissioned a brand assessment of Energy Upgrade California among residential consumers and small businesses. The information gained from the assessment is being used to inform the transition of Energy Upgrade California. Some key findings are cited below:

- Brand awareness was extremely low. Out of 2,000 respondents, the survey found that less than 1 percent of residential customers could name Energy Upgrade California as a statewide initiative to encourage energy savings.
- Seventeen percent of respondents had heard of Energy Upgrade California when provided the name. But these same respondents did not know much about it. Only 2 percent of respondents self-reporting that they are knowledgeable about the initiative.
- For commercial customers, small business owners' awareness was similar to that of residential customers, with less than 1 percent awareness for unaided knowledge of Energy Upgrade California, and 15 percent having heard of it when aided by name.
- Awareness and knowledge of energy management opportunities in general is limited. Respondents were most knowledgeable about solar and demand response concepts, and least knowledgeable about home energy assessments, smart meters, and time of use payment options.
- The low recognition and knowledge levels present an opportunity for Energy Upgrade California's expansion and brand transition, as not a lot of Californians have already formed opinions of the brand.[128]

As marketing is a component of many utility programs, it is often evaluated along with the program. While the CPUC did not conduct evaluations for all program marketing activities in the 2010-2012 cycle, marketing components were included in two evaluations of non-residential programs for Southern California Gas Company and San Diego Gas and Electric in March 2012[129]. The evaluations found several areas where improvement is needed, which were similar for both utilities.

- Program marketing groups were operating in isolation and lacking a unified, high-level marketing strategy.

128 See Energy Upgrade California Brand Assessment Study at http://energycenter.org/sites/default/files/docs/nav/programs/swmeo/Energy%20Upgrade%20California%20Brand%20Assessment_FINAL%20Report.pdf

129 See San Diego Gas and Electric's Non-residential Process Evaluation Study: Main Report, Heschong Mahone Group, March 2012, at http://www.calmac.org/%5C/publications/SDGE_NR_Process_Eval_Final_Report_-_Main_Report.pdf ; and, Southern California Gas' Non-Residential Process Evaluation Study: Main Report, Heschong Mahone Group, March 2012, at http://calmac.org/publications/SCG_NR_Process_Eval_Final_Report_-_Main_Report.pdf

- Account executives were not properly informed or motivated to successfully promote energy efficiency programs.
- Account executives have individual energy efficiency goals and regular program training, but some account executives do not appear to be properly informed or motivated to successfully promote efficiency programs.
- Some information on the websites is out of date.

Recommendations

Several recommendations for program improvement and direction emerged from these recent studies.

- According to the Energy Upgrade brand assessment, the lack of awareness of the brand, and the fact that most do not associate it with the Home Upgrade Program, leaves an "open door" to change and expand the brand. This is true with both residential and small commercial customers.
- The evaluation of the SCG and SDG&E non-residential programs had numerous, specific recommendations listed. These include performing a program resource inventory, developing a responsibility matrix at the portfolio level, improving collaboration with CPUC to "to maximize value of requirements, and minimize resource cost to meet them," and several other recommendations for each section.

The non-residential program assessment, or best practice, evaluations also recommend that the IOUs:

- Develop a comprehensive marketing plan that is shared with all staff.
- Hold semi-annual meetings with all staff involved with marketing.
- Offer incentives to vendors to promote their programs.
- Keep websites up to date.
- Coordinate a portfolio marketing campaign that includes all programs to raise awareness and lend credibility to others that are promoting programs.

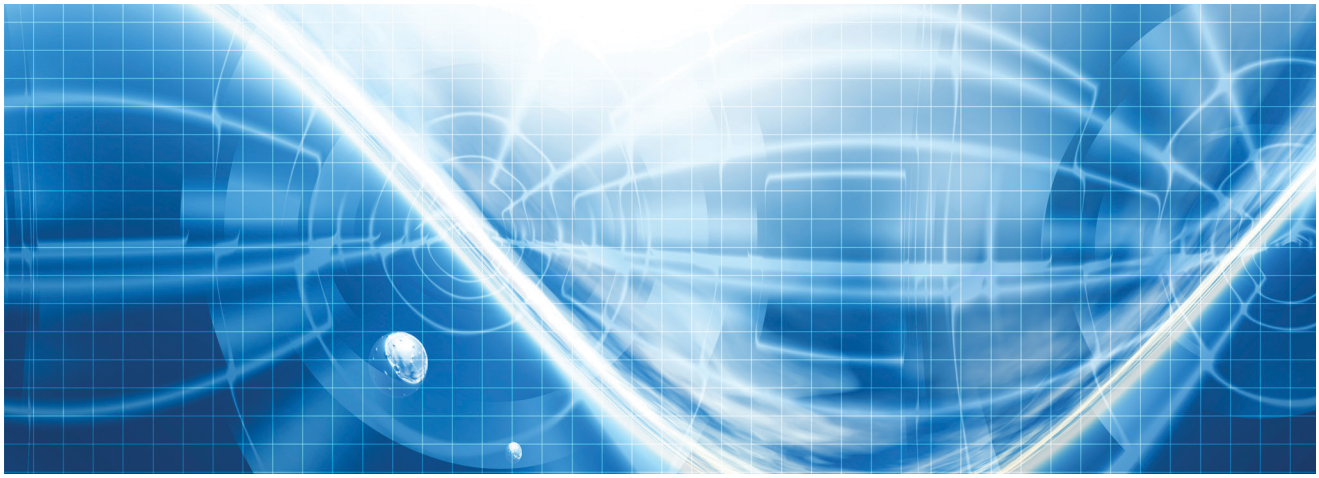
While marketing is critical for the success of all demand side programs, CPUC staff finds it difficult to evaluate marketing activities as they are currently embedded in the utilities' programs. The exceptions are when specific process evaluations are performed for programs such as the non-residential evaluations cited in this chapter. But there is no uniform method for the IOUs to propose marketing plans, or for the CPUC to evaluate marketing campaigns. Therefore, Commission staff recommends the following:

- The CPUC should include in the ME&O evaluation roadmap a cross cutting review of marketing activities of local programs so stakeholders can better understand marketing activities, how they relate to each other, and how they relate to the statewide campaign.
- The IOUs develop a consistent format for submitting marketing plans for each of their local programs. This format could include marketing design details, how the program relates to their other programs, how the program relates to statewide marketing, the target audiences, relevant metrics, and a detailed budget.

For More Information

- The proposed Statewide Marketing Plan, the Energy Upgrade California Brand Assessment, and the website assessment are available at http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Statewide+Marketing.htm
- The Energy Upgrade California website is available at www.EnergyUpgradeCA.org .

Emerging Technologies



Overview

The Emerging Technologies Program (ETP) is designed to support market demand for and supply of new energy efficient technologies and approaches. Driving demand and supply is accomplished by development and deployment of new and under-utilized energy efficient products, practices, and tools, and by introducing them into the IOUs' energy efficiency programs. Also, ETP supports the broader market by sharing research results and providing product development support to innovators. As evidenced by the significant increase in budget over the previous cycle and the increased scope of activities, the CPUC continues to consider ETP important as the state works towards the Strategic Plan's goals, such as zero net energy (ZNE) goals for commercial and residential buildings.

Emerging Technology Program

ETP is classified as a non-resource program in the 2010-2012 program cycle, which means it does not claim energy savings. The 2010-12 ETP budget was approximately 1.5 percent of the total portfolio budget, and a majority of the funds were used for assessing the potential savings claims of new and/or unproven energy efficiency technologies.[128] To meet the needs of certain technologies, practices or approaches, ETP has up to six years to execute and complete a project, with individual projects that may span more than one program cycle. This is evident in the program's reported expenditures, which reached 75 percent of the total approved budget by the end

128 Source: IOUs 2010-2012 Energy Efficiency Portfolio Program Implementation Plan, Statewide Emerging Technologies Program (March/2009, revised January/2011)

of 2012. The program will carry over 25 percent of its 2010-2012 budget to fund 2012 projects still under way through the transition period ending 2014, with the funding added to the approved 2013-2014 budget of $38 million.[129]

Table 20. Emerging Technologies Sector Budget

	Expenditures (millions $)
Reported December 2012	$32.3
Carry over through 2014	$11.0
Total Revised Budget[130]	$43.3

Program Summary

ETP's implementation approach consists of assessing technologies for possible inclusion in the downstream energy efficiency programs, increasing visibility of new technologies (e.g., new building controls or LED lights) and conducting research on customer decision-making and market behavior. The program also works to increase technology supply by bridging research and development, including the development of networking opportunities and training for entrepreneurs. Finally, ETP supports ZNE by advancing innovative measures or strategies and supporting ZNE-specific research.

Table 21. ETP Budget Breakdown*

Subprogram	Millions	%
Technology Assessment	$29.4	68%
Scaled Field Placement	$2.9	7%
Demonstration Showcase	$5.0	12%
Market and Behavior Studies	$1.6	4%
Technology Resource Incubator Outreach (TRIO)	$1.2	3%
Technology Development Support	$0.8	2%
Technology Test Center	$2.2	5%
Total	**$43.3**	**100%**

** Source: IOUs 2010-2012 Energy Efficiency Portfolio Program Implementation Plan, Statewide Emerging Technologies Program (March/2009, revised January/2011)*

Highlights

Evaluation results from 2010-2012 showed that ETP appears to be meeting its objectives of supporting the IOUs' energy efficiency portfolio, the California Energy Efficiency Strategic Plan, the Big Bold

129 D. 12-11-015 at 104

130 The original ETP approved budget was $55.8 million but was reduced to $43.3 million due to a fund shift request approved via Disposition on PG&E's Advice Letter 3235-E-A/3901-E-A dated 02/14/2012. Source: http://www.pge.com/nots/rates/tariffs/tm2/pdf/GAS_3235-G-A.pdf

Strategies and the market in general.[131] Due to the limitations of the effectiveness evaluation conducted as part of the Phase II of the study, with many program elements being relatively new to this cycle and the long term characteristics of certain projects and activities, the monitoring and evaluation of activities will continue to more fully assess effectiveness.

The 2010-12 portfolio ETP included many accomplishments worthy of highlighting:

- 73 percent of the 288 projects initiated during the 2010-2012 cycle align with the Big Bold Strategies end uses.[132]
- ETP is in most cases disseminating information about emerging technologies and approaches — program participants and target audiences[133] reported increased knowledge of energy efficiency technologies and approaches due to the program's activities.
- ETP reports supported IOU program managers when considering which technologies should be adopted into the IOU portfolios.
- The program promoted networking and facilitated innovator access to investors and IOU incentive programs.

Findings

The 2010-2012 ETP evaluation was completed in 2013. The study included a program design and implementation assessment as well as an effectiveness assessment. The effectiveness assessment looked at how ETP increased technology supply as well as adoption of measures, its alignment with the Strategic Plan, and performance metrics. Following are key findings from the evaluation study.

The program design assessment concluded that the program is being mostly implemented according to the original implementation plan. However the program could benefit from improving alignment of activities and targeted outcomes and implementation of activities:

- Technology assessment reports need additional clarity, specifically improvements in engineering detail.
- Not all IOUs have clear and specific selection tools for demonstration showcase projects that consider visibility, audience, and the ability for knowledge transfer.

131 PY2010-2012 California Statewide emerging technologies Program Evaluation Phase I Report: Volume I - Findings http://www.calmac.org/publications/PY2010%2D2012%5FPhase%5FI%5FETP%5FStatewide%5FEvaluation%5FReport%5FVolume%5FI%2Epdf PY2010-2012 California Statewide Emerging Technologies Program Evaluation Phase I Report: Volume II – Appendices http://www.calmac.org/publications/PY2010%2D2012%5FPhase%5FI%5FETP%5FStatewide%5FEvaluation%5FReport%5FVolume%5FII%2Epdf PY 2010-2012 California Statewide Emerging Technologies Program Phase II: Program Effects Report - Volume I http://www.calmac.org/publications/ETP%5FPhase%5FII%5FProgram%5FEffects%5FReport%5FVolume%5FI%5FFINAL%2Epdf PY2010-2012 California Statewide Emerging Technologies Program Phase II: Program Effects Report - Volume II http://www.calmac.org/publications/ETP%5FPhase%5FII%5FProgram%5FEffects%5FReport%5FVolume%5FII%5FFINAL%2Epdf PY2010-2012 California Statewide Emerging Technologies Program Phase II Program Effects Report - Technical Potential Addendum http://www.calmac.org/publications/ETP%5FPhaseII%5FTechPotential%5FAddendum%5FFINAL%2Epdf

132 The end-use areas considered to be in support of the Big Bold strategies of the California Energy Efficiency Strategic Plan are: lighting, plug-loads and controls, HVAC, Zero Net Energy, building systems, diagnostics and integrated design, demand response and renewable and storage.

133 ETP's target audience for reports is the Energy Efficiency program managers and other decision makers involved in the process of adopting technologies into the EE portfolio and the public assessing the project reports published on the Emerging Technologies Coordinating Council (ETCC) website (www.ettc-ca.com). The study was able to interview program managers but could not reach visitors of the ETCC website.

- Even though ETP is a statewide program, implementation activities varied across the IOUs in terms of available budgets, criteria for selecting projects, implementation processes, reporting and level of activity (e.g., SCE has screening and scanning tools that reflect the needs of individual elements and the Strategic Plan).
- Most importantly, activity targets are not well aligned to each program element to reflect budget allocation and expected activity. Based on the analysis of the results, ETP significantly exceeded its objectives in both projects initiated and number of measures transferred. While admirable, this also may be a function of overly conservative targets in the planning phase, as ETP exceeded all of its numeric objectives suggesting that targets may not be reflecting the program's level of potential activity. The program initiated 302 projects (288 projects and 14 outreach events). The original statewide objective was 121 projects.

The effectiveness assessment tested whether ETP's activities supported the objectives of increasing supply and demand of energy efficiency technologies; if the activities were supporting the Strategic Plan; and how the program performed against the pre-defined performance metrics. Table 22 provides a summary of the ETP activities in 2010-2012:

The program supported the adoption of new measures into the EE portfolio. ETP is responsible for recommending measures for adoption but the final decision for adoption lies outside ETP. ETP recommended 61 projects for adoption and 19 of those resulted in the 58 measures adopted. [134]

134 It is important to note that due to time lag between recommendation and adoption of a measure, more recommended measures may be eventually adopted into the EE portfolio.

Table 22. Summary of ETP activities during 2010-2012 cycle

	Increase Technology Supply		Increase Technology Demand			
	TRIO events	TDS projects	TA	MBS projects	SFP projects	DS projects
PIP numerical objectives	9	6	73 projects 35 measures adopted	4	15	14
Initiated projects	14	18	188 projects	21	30	31
Measures adopted into the portfolio	N/A	N/A	58 measures	N/A	N/A	N/A
Average project duration (months)	N/A	11	13	8	13	9
Activities in support of CEESP	35%	61%	63%	76%	90%	100%

Source: Phase II ETP Effectiveness Evaluation

ETP is improving knowledge of program participants and stakeholders via effective execution of Scaled Field Placement (SFP), Demonstration Showcases (DS).

Finally, the program did increase technology supply via its outreach events. The Technology Resource Incubator Outreach (TRIO) promotes networking opportunities; helps bring technologies to market or to have them included in the IOU EE portfolio. Twenty incubator survey respondents submitted a technology to the IOUs, of which eight were accepted.

Recommendations

Several critical recommendations for improving the program emerged from the evaluations completed in the past year.

- As the ETP expands its activities to formally include demonstrations, targeted research, development support and networking activities, the program has to refine its planning and project prioritization activities.
- To properly assess effectiveness, program metrics and success criteria must be defined that most appropriately reflect the objectives of the program.
- The program needs to improve reporting of activities to ensure transparency. Two of the program performance metrics, number of measures adopted into the portfolio and the technical potential of these measures, could not be properly assessed due to incomplete information provided by the IOUs. This analysis is available in an Addendum to the Phase II report.[135]
- Timing of the evaluation may not capture all of the program activities as projects may extend beyond portfolio cycle time frames, hence evaluation needs to be on going. The time lag between recommendation of projects and actual adoption decision may distort program outcomes compared to short term metrics.
- Program design improvements include:
  - technology assessments should enhance quality of reporting;
  - demonstration showcases could enhance the quality of efforts through explicitly identifying the target audience prior to designing a project;
  - market and behavior studies reporting should be more timely to inform internal decision making;
  - improve documentation of technology development projects.
- Each IOU should comprehensively and accurately track ongoing activities in the ETP database. Tracking should be comprehensive and stress timely communication to inform ongoing activities and status to the CPUC and evaluators.[136]

135 PY2010-2012 California Statewide Emerging Technologies Program Phase II Program Effects Report - Technical Potential Addendum http://www.calmac.org/publications/ETP%5FPhaseII%5FTechPotential%5FAddendum%5FFINAL%2Epdf

136 In order to improve basic reporting capabilities to accommodate the needs of ETP, energy division has revised the structure of the ETP database. It is possible that further revisions will be necessary to accommodate further changes in the program activities.

For More Information

Findings from studies related to emerging technologies may be found at calmac.org. The studies are listed below:

- PY2010-2012 California Statewide emerging technologies Program Evaluation Phase I Report: Volume I - Findings http://www.calmac.org/publications/PY2010%2D2012%5FPhase%5FI%5FETP%5FStatewide%5FEvaluation%5FReport%5FVolume%5FI%2Epdf
- PY2010-2012 California Statewide Emerging Technologies Program Evaluation Phase I Report: Volume II – Appendices http://www.calmac.org/publications/PY2010%2D2012%5FPhase%5FI%5FETP%5FStatewide%5FEvaluation%5FReport%5FVolume%5FII%2Epdf
- PY 2010-2012 California Statewide Emerging Technologies Program Phase II: Program Effects Report - Volume I http://www.calmac.org/publications/ETP%5FPhase%5FII%5FProgram%5FEffects%5FReport%5FVolume%5FI%5FFINAL%2Epdf
- PY2010-2012 California Statewide Emerging Technologies Program Phase II: Program Effects Report - Volume II http://www.calmac.org/publications/ETP%5FPhase%5FII%5FProgram%5FEffects%5FReport%5FVolume%5FII%5FFINAL%2Epdf
- PY2010-2012 California Statewide Emerging Technologies Program Phase II Program Effects Report - Technical Potential Addendum http://www.calmac.org/publications/ETP%5FPhaseII%5FTechPotential%5FAddendum%5FFINAL%2Epdf
- Best Practice Guideline for Emerging Technology Assessments: California Statewide Emerging Technologies Program http://www.calmac.org/publications/ETP%5FBest%5FPractices%5FGuidelines%5FPublished%2Epdf
- Technology Development Actors Study http://www.calmac.org/publications/CALMAC%5FSTUDY%5FID%5FSCE0333%2E01%5FETP%5FTechnology%5FDevelopment%5FActors%5Ffinal%5Freport%5FI2%2D14%2D2012%2Epdf

Other Resources

In addition, the Research and Technology Action Plan will guide the implementation of key initiatives in 2012-2015 timeline for the RD&D community.[137]

137 See the Plan at http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp/Research+and+Technology+Action+Plan.htm

Government Partnerships

Overview

Government Partnerships consist of partnerships between local governments and the IOUs to achieve energy efficiency savings within public facilities and hard-to-reach segments of the community such as small businesses. These IOU-administered programs support both near- and long-term portfolio savings objectives, as well as advancement of the Strategic Plan's local government element. In an effort to track the progress of these programs, the CPUC and the IOUs sponsored evaluations of Government Partnerships energy efficiency programs and measures to estimate programs' savings and progress towards reaching Strategic Plan goals.

Estimated Savings

At the end of the 2010-2012 program cycle, the IOUs spent approximately $209 million (8 percent of total portfolio expenditures) on government partnerships efficiency programs, resulting in evaluated savings of 243 GWh and 40 MW, representing approximately three percent of both total portfolio electric savings and demand savings. About 65 percent of the savings were directly attributable to the program intervention. Natural gas savings within this sector was about 1 million therms and made up less than one percent of the total portfolio. The government partnerships sector was not the focus of significant impact evaluation work during the 2010-2012 program cycle, with the exception of being included in the commercial lighting impact evaluations, because overall they

Table 23. Local Government Partnerships Sector IOU-reported Savings and Budget Snapshot

		Expenditures	Energy Savings			Emissions	Cost Effectiveness
		Million ($)	Electric (GWh)	Demand (MW)	Natural Gas (MM Therms)	CO_2 (Tons)	TRC
Reported	Gross	209	398	71	0	225	1.32
	Net		287	52	0	162	0.98
Evaluated	Gross		240	40	1	141	0.81
	Net		158	26	1	92	0.56

did not make up a big portion of the total portfolio savings.

Roughly 76 percent of the evaluated electric savings in the government partnerships come from lighting measures; refrigeration, process and HVAC make up about 20 percent. For natural gas savings, water heating and HVAC makes up make up the majority of savings. The lighting and HVAC program impacts are included in separate chapters, and the savings impacts from these end uses are included in this government partnership focused chapter to show the contribution to savings in this sector.

The savings verified through evaluation were about half of those claimed, primarily as a result of field evaluations on commercial lighting which sampled sites within these programs. About 90 percent of the electric reported claims were reviewed through the field evaluation activities. Natural gas savings for the sector were higher than expected, due to lower electric savings realized through lighting interventions and resulting in diminished negative interactive effects (higher electric savings from lighting results in greater heating load and vice versa). The savings directly attributable to the program interventions were initially assumed to be about 70 percent, and after field evaluation including interviews with customers and review of practices in the market, direct influence was determined to be closer to 66 percent.

The programs in this sector were not cost effective. One explanation for this is that many of these programs support non-resource activities like training and outreach. Roughly 30 percent were for non-resource costs.

Savings in this sector are attributable to activities that promote government building retrofits and local government support of customer participation in IOU-administered programs, including retrofits of small commercial buildings and targeted energy upgrades in the single-family residential sector. These savings contribute towards meeting the portfolio energy savings goals, but they represent just one component of the local government initiatives, as noted in the next section.

Government Partnerships Energy Efficiency Programs

Government Partnerships include a broad range of operating contexts, and include statewide institutional partnerships; regional partnerships; partnerships with

single cities or counties; informal groups of local governments; Councils of Government (COGS); other Joint Power Authority (JPA) partners; and, community-based non-profit partners. Consistent among the Government Partnerships is that program activities (residential and nonresidential) are guided by the Strategic Plan.

More than 50 local governments, regional governments, non-profits, and joint powers authorities are under contract with the IOUs as energy efficiency partners to deliver energy efficiency programs and services, often in coordination with multiple neighboring jurisdictions. Generally, a local government partnership consists of three broad program areas with some variation depending on the utility territory and the partnership's special needs or capabilities:

- Upgrading public buildings through retrofits, retro-commissioning, integrated demand response, technical assistance, and on-bill financing.
- Promoting IOU energy efficiency and demand response programs by providing local marketing, direct installations for residential and small business customers, and retrofits for moderate income populations.
- Supporting the Strategic Plan, which includes benchmarking, GHG inventories, drafting of climate action plans, and energy action plans; developing reach codes that exceed Title 24 standards; improving code compliance; promoting information sharing and knowledge transfer between LGs; and, promoting community energy efficiency financing with attractive terms.

Highlights

An annual best practices report[138] prepared for the CPUC summarized activity of government partnerships during 2010-2012 program cycle. The report tracks progress of all 540 cities and counties statewide on strategic indicators, including progress on adopting reach codes, code compliance, and other efforts. Report highlights include:

- Many cities and counties in Government Partnership plan to benchmark their facilities. 68 cities and counties have completed benchmarking of some facilities and more are in some stage of the process.
- Government Partnerships use utility management software to manage energy consumption and track municipal energy use. Los Angeles County developed the Enterprise Energy Management Information System, which is being made available for other cities and counties to use.
- 69 cities and counties completed climate action plans by the end of program cycle. Sixty Government Partnerships or cities receiving SCE strategic planning grants are working on some aspect of energy/climate action planning in their relationships with utilities and chose to work on energy or climate actions plans as part of their partnership strategic planning efforts.
- Approximately 150 cities and counties in the state are on track to achieve the 2015 goal of Climate Action Plan adoption. These plans involve setting emissions reduction goals and

138 Third Annual Report from Statewide Local Government Energy Efficiency Best Practices Coordinator, February 2013 http://eecoordinator.info/coordinator-reports/

implementing measures to achieve those goals.

Findings

The *Local Government Partnerships Assessment Report* examined why and under which conditions some local government partnerships may have more success than others in demonstrating progress in achieving energy efficiency savings and meeting long-range goals. [139] The report identified a number of common qualities of successful government partnerships, with the two most critical factors being an adopted energy or climate action plan and dedicated staff with a deep understanding of efficiency program management. Specifically, the study found that the key staff functions and characteristics that lead to success for the partnerships are:

- Staff continuity and a deep institutional understanding of energy efficiency and climate action planning with an effective network and an understanding of program implementation and management.
- Leveraging of limited local government staff with an effective third-party implementer is an effective strategy to gain incremental in-house capability and advance local energy efficiency goals.

Recommendations

Based on interviews with key program implementers, IOU program managers, partners and stakeholders, a wide range of recommendations to improve programs were listed in the local government assessment report. Some of the recommendations include:

- Develop metrics for local government participation and engagement which include strict tracking and reporting requirements.
- Develop a set of data rules and protocols that are comprehensive, consistent, clear, fairly applied and reflect current uses and applications of data.
- Set realistic, short-term goals for Government Partnerships that lack energy efficiency staff expertise.
- Start new Government Partnerships with a narrow scope and clear resource direction to ensure a greater chance of success.
- Develop regional versus city-level energy efficiency infrastructure (as appropriate).

For More Information

Findings from studies related to local government partnerships for the 2010-2012 Evaluation, Measurement and Evaluation Plan cycle may be found at www.energydataweb.com/cpuc/ and www.calmac.org.

Completed Studies:

- Third Annual Report from Statewide Local Government Energy Efficiency Best Practices Coordinator http://eecoordinator.info/coordinator-reports/
- Nonresidential Program Assessments Study, Local Government Partnerships http://calmac.org/publications/LGP_Program_Assessment_Report_-_final.pdf .
- 2010-12 CPUC Nonresidential (Non-Core) Audit Evaluability Assessment

139 See Nonresidential Program Assessment, PY 2010-2012, Local Government Partnerships, Evergreen Economics, July 2013, at http://calmac.org/publications/LGP_Program_Assessment_Report_-_final.pdf .

http://www.calmac.org/publications/LGP3P_EvaluabilityAssessment_FinalReport_20140624.pdf

- 2010-12 WO033 Custom Impact Evaluation Final Report (includes Government Partnership results) http://www.calmac.org/publications/2010-12_WO033_Custom_Impact_Eval_Report_Final.pdf
- Nonresidential Downstream Lighting Impact Evaluation http://www.energydataweb.com/cpucFiles/pdaDocs/1155/Nonresidential%20Downstream%20Lighting%20Impact%20Eval%20Final%20Report.zip

Lighting

Overview

Lighting represents over one quarter of residential and commercial electricity use in California and has historically represented half or more of the IOUs' portfolio savings.[140, 141] The Strategic Plan cites energy efficient lighting as a critical element of its zero net energy vision, and envisions a 60 to 80 percent reduction in California's electric lighting energy consumption by 2020 (over a 2010 baseline).[142] The California Lighting Efficiency and Toxics Reduction Act (also known as "the Huffman Bill or California Assembly Bill 1109") supports this goal by phasing out some traditional, low efficiency incandescent lamps by 2018, but additional program support is necessary. For this reason, the CPUC has directed the IOUs to shift energy efficiency program support away from basic spiral compact fluorescent lamps (CFLs) and toward more efficient lamps and other advanced lighting technologies (e.g., light-emitting diode or LEDs). [143]

Estimated Savings

There are 138 programs or subprograms in the IOUs' 2010-2012 portfolios that include lighting measures;

140 California Energy Commission, 2011. 2011 Integrated Energy Policy Report. Publication Number: CEC-100-2011-001-CMF.
141 In the 2006-2008 program cycle, 58 percent of the evaluated electric savings came from indoor lighting. California Public Utilities Commission, 2010. 2006-2008 Energy Efficiency Evaluation Report. July, 2010; page iii.
142 California Public Utilities Commission, 2008. California Long Term Energy Efficiency Strategic Plan. September, 2008.
143 California Public Utilities Commission, 2009. D.09-09-047: Decision Approving 2010 to 2012Energy Efficiency Portfolios and Budgets. Page 7. October 1, 2009.

these programs are delivered in all sectors through a range of mechanisms. Since lighting measures cut across multiple market sectors, savings estimates presented in other chapters in this report may overlap with the lighting savings estimates included in this chapter.

At the end of the 2010-2012 program cycle, the IOUs energy efficiency lighting programs resulted in evaluated savings of 3,527 GWh[144] and 516 MW, representing 69 percent of total portfolio electric savings and 72 percent of total demand savings. Approximately 64 percent of electric and demand savings were directly attributable to program interventions. When looking at the difference between gross and net evaluated savings, the major contributing factor is the basic CFL reflector, representing 39% of the change from total gross GWh savings to total net GWh savings.

Lighting Programs

Of the dedicated lighting programs in the portfolio those with the greatest savings are the residential lighting incentive programs for basic CFLs, advanced consumer lighting, and commercial lighting incentives. These programs all offer incentives for specific technologies via an upstream, downstream or direct install program delivery model.

The three charts below are based on the final statewide evaluated data set, where the evaluated results from the impact studies are applied to the population, for applicable measures. Some measures, like most LEDs and most controls, were not evaluated and

144 This total includes savings from bulbs that are in storage, and that would likely be installed in subsequent years, but are being credited all in 2010-2012. This could be as much as 674 GWh. See appendix for more information.

Table 24. Lighting Sector Savings and Budget Snapshot*†

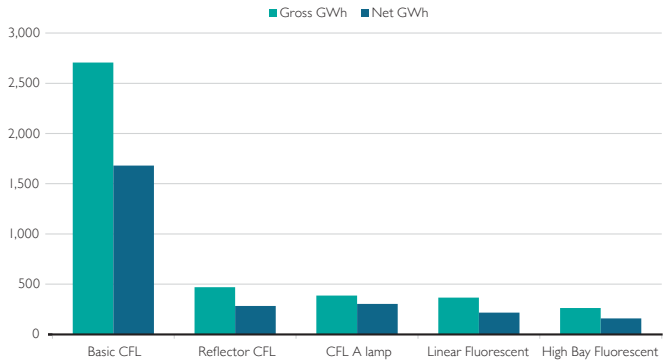
		Expenditures	Energy Savings			Emissions	Cost Effectiveness
		Million ($)	Electric (GWh)	Demand (MW)	Natural Gas (MM Therms)	CO_2 (Tons)	TRC
Reported	Gross	168†	3,397	501	-34	1,700	5.88
	Net		2,265	336	-22	1,139	4.50
Evaluated	Gross		3,527	516	-31	1,787	6.50
	Net		2,279	333	-20	1,156	4.76

** Energy Division applied evaluated results to the IOU tracking data where applicable. Some measures were not evaluated and were passed through. This data reflect statewide savings for the lighting specific programs.*
† The negative therm savings are the result of the interactive effects of more efficient lighting on heating and cooling loads.

were thus passed through. Details about the data set are provided in the Appendix.

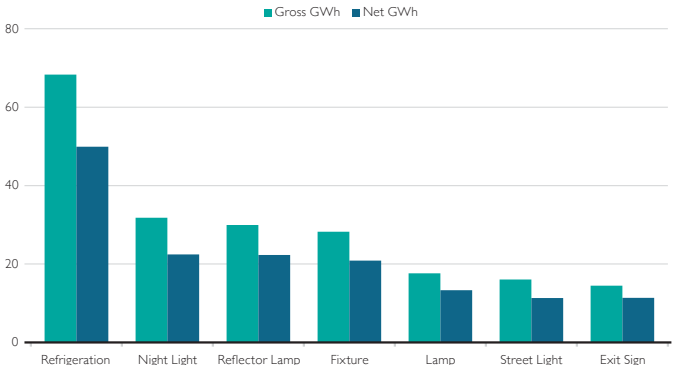
At the technology level, the five biggest contributors to lighting kWh savings are all indoor lighting applications and these five technologies alone represent 52 percent of all the electric savings for the entire 2010-2012 statewide portfolio. Figures 6 and 7 highlight two groups of technologies that may play an important part in the future of California's energy efficiency portfolio.

Figure 6. Top Lighting Technologies Generating Greatest Share of Gross Electric Savings for Lighting, Statewide 2010-2012



It is worth noting that LEDs, which are expected to provide significant efficiency savings in the future, are still a small portion of the lighting portfolio, accounting for almost five percent of the total gross electric savings from all lighting technologies. Figure 6 shows the top 7 LED technologies from the 2010-2012 portfolio, with refrigeration case lighting as the top LED technology generating 68 GWh of electric savings during 2010-2012. Indoor LED lamps and reflectors combined to generate 7 GWh of savings during the 2010-2012 cycle.

Figure 7. Top Seven LED Technologies Generating the Greatest Gross Electric Savings[145], Statewide 2010-2012



Similarly, individual control technologies, which are now part of code but when combined with other control strategies may create future savings opportunities, combine to make up two percent of all statewide electric savings in the 2010-2012 period. Figure 8 shows all seven control technologies that were offered in 2010-2012, with indoor wall or ceiling mounted occupancy sensors generating the largest share of savings of all the individual control measures.

145 Except for refrigeration case LED lighting, none of the LED technologies in the portfolio received an evaluation adjustment in the 2010-2012 cycle.

Figure 8. Top Seven Control Technologies Generating the Greatest Gross Electric Savings[146], Statewide 2010-2012

Findings

The CPUC conducted several lighting studies and provide a wealth of information on the lighting sector. This section highlights just a few of the key findings that stand out.

- Residential upstream per unit gross savings estimates were reduced by about a third due to ex-post adjustments to the estimates for annual operating hours, peak coincidence factors and delta watts. Annual operating hours were about three-fourths of ex-ante assumptions and peak coincidence factors came in between half and two-thirds of the ex-ante assumptions.[147]
- An installation rate of 97 percent is being applied to all evaluated residential upstream CFLs. The 97 percent installation rate is based on telephone surveys with consumers and previous installation rate research that suggests CFLs purchased by residential customers all get installed within four year time range of purchase, except for 3 percent that never get installed. The 97 percent installation rate eliminates the need for carryover analysis to be applied to future upstream programs.[148]
- At the statewide level for Nonresidential CFL Basic measures, the kWh Gross Realization Rate (GRR) is 38 percent. The overall installation rate is 77 percent. Ex-post operating hours are only about half of the ex-ante value. Delta watts, however, are in line with ex-ante values. The kW GRR has a value of 49 percent due to the ex-post coincidence factors being about 35 percent lower than ex-ante.[149]
- At the statewide level for Nonresidential Linear Fluorescent measures, the kWh GRR is 63 percent. The overall installation rate is 92 percent. Ex-post operating hours are about 20-25% lower than the ex-ante value. Delta watts are about 10-15 percent lower than ex-ante values. The kW GRR has a value of 53 percent, due to the ex-post coincidence factors being about 35 percent lower than ex-ante.[150]
- At the statewide level for Nonresidential Occupancy Sensors measures, the kWh GRR is 57 percent. The overall installation rate is 92 percent. The reduction in ex-post operating hours is about 10-15 percent lower than ex-ante, and the controlled wattage is about 30 percent lower than ex-ante. The kW GRR is 40 percent, due to the reduction in the

146 Except for the wall or ceiling mounted occupancy sensors, none of the control technologies received an evaluation adjustment in the 2010-2012 cycle.
147 Page XII, California Upstream and Residential Lighting Impact Evaluation, DNV GL, July 2014
148 Page 3-2, California Upstream and Residential Lighting Impact Evaluation, DNV GL, July 2014
149 Page 5-12, Nonresidential Downstream Lighting Impact Evaluation Report, Itron, August 2014.
150 Page 5-13, Nonresidential Downstream Lighting Impact Evaluation Report, Itron, August 2014.

ex-post coincidence factor being about 40 percent lower than ex-ante.[151]

- For CFL reflectors and globes, the average incremental costs are estimated to be below $3/lamp, which represents a larger relative decrease from previous DEER estimates (>$8/lamp). For LEDs, the average incremental cost for all lamp shapes is still high relative to both incandescent and CFL bulbs, ranging from $7/lamp for torpedoes to $24 - $33/lamp for A-lamps and $40 – 50/lamp for reflectors.[152]
- Incandescent lamps continue to have the highest saturation of any lamp type (47.8 percent), with CFLs a distant second (29.2 percent) and LEDs with 1.2 percent saturation.[153]
- Halogen lamps have also grown in popularity, from 4 percent in 2005 to approximately 8 percent in 2012. This trend is likely due to the emergence of MR-16 style lamps which are being specified more often in new construction and remodels.[154]
- Slightly more than half of linear fixtures purchased from 2009 to 2012 by nonresidential customers in California are High Efficiency units. High efficiency technologies include High Performance T8, Reduced Wattage T8, T5, and Linear LEDs. Base Efficiency technologies include T12, Standard 700-Series T8, and Standard 800-Series T8. The California Market Share Tracking data indicates that Reduced Wattage T8s have experienced a significant increase in installations in California business from 2009-20012.[155]
- As of April 2014, prices for 60 watt equivalents have fallen below $10 per unit online and are roughly equivalent in large home improvement stores. This compares to prices for all types of LED lamps in the $15 range recorded in the shelf surveys conducted for this study in 2013. Comparison of the results of shelf surveys undertaken in California in 2012 and 2013, however, indicate that these price decreases are not universal across product types (form factors) or channels. For example, the price of A-lamps sold in big box stores decreased by roughly two dollars between 2012 and 2013, while it increased by $1.50 at all other types of retailers. Similarly, the average price LED reflector lamps decreased by $6.50 per unit at big box stores while increasing by roughly one dollar at other retailers. Retailers continue to identify high first cost as the major barrier to LED sales to residential customers.[156]
- Based on in-home lighting inventory results, PG&E, SCE, and SDG&E residential electric customers increased their CFL installations by an average of three lamps per household between 2009 and 2012. CFLs were widely available in retail stores: in both 2012 and 2013, roughly 90 percent of California retail stores that stocked replacement lamps had CFLs in stock. However, within these stores, CFL stocking declined substantially. The share of total lamp stock comprised by CFLs in

151 Page 5-13, Nonresidential Downstream Lighting Impact Evaluation Report, Itron, August 2014.
152 Page 3-25, Measure Cost Study, Itron, June 2014.
153 Page 1-5, California Lighting and Appliance Saturation Study, DNV GL, June 2014
154 Page 4-14, California Lighting and Appliance Saturation Study, DNV GL, June 2014
155 Page ES-7, California Commercial Market Share Tracking Study, Itron, July 2014
156 Page 4, LED Lighting Market Baseline Characterization: Phase I Market Effects Study of IOU Programs, DNV GL, July 2014

retail stores dropped significantly between 2012 and 2013, and halogen lamps filled most of the gap. In terms of absolute quantities of lamp stock, results from a limited set of stores suggest that the quantity of CFLs in stock declined by roughly one-fourth between 2012 and 2013. These results are largely driven by dramatic declines in big box stores—and in wholesale clubs in particular—between years. Many supplier representatives attribute these declines to declining support over time for these CFLs through the ULP, especially for basic spiral CFLs. Most lamp manufacturers suggested that the ULP exerted considerable influence on their market activities.[157]

- The percentage of stores stocking halogen lamps went up by 40 percent between 2012 and 2013, with roughly two-thirds of stores stocking these products during the 2013 shelf survey visits. Halogen lamps also doubled their share of total retail lamp stock in California between 2012 and 2013 (from 7 to 14 percent of stock) and, based on results from a limited set of stores, exhibited dramatic increases in the total quantity of lamps stocked (particularly in big box stores). Lamp suppliers suggest that this influx of halogen lamps is likely a result of EISA and AB 1109 and the associated phase-out of traditional incandescent lamps beginning in January, 2011 in California.[158]

157 Page 166, California Residential Replacement Lamp Market Status Report: Upstream Lighting Program and Market Activities in California Through 2013, DNV GL, September 2014

158 Page 168, California Residential Replacement Lamp Market Status Report: Upstream Lighting Program and Market Activities in California Through 2013, DNV GL, September 2014

Recommendations

Commercial Lighting Programs Need More Attention Considering Commercial Potential

While there continues to be significant savings coming from lighting as an end-use, at the sector level there is quite a different story. The California Upstream and Residential Lighting Impact Evaluation, which represent 29 percent of statewide electric savings claims, found savings came in as expected, with 99 percent of the savings verified and through field work. Shares of total lamp stock comprised of CFLs dropped significantly between 2012 and 2013, possibly as a result of decreased program support.[159] However, the residential lighting program overall continues to make a difference in California's lighting market by targeting segments of the population that may not yet have made an energy efficient lighting decision. The Nonresidential Downstream Lighting Impact Evaluation Report, which represents 23 percent of statewide electric savings claims, found savings did not materialize as expected. Fifty-three percent of savings were verified in the field.[160] If the "commercial sector will continue to drive savings for IOU programs" as identified in the 2013 Potential study[161], with "a significant portion of remaining potential available in lighting end uses (particularly in the commercial sector),"[162] then the commercial lighting programs will need to address issues driving the low gross realization rates found in the Itron report: improving estimates of the hours of operations for certain technologies,

159 Page 166, California Residential Replacement Lamp Market Status Report: Upstream Lighting Program and Market Activities in California Through 2013, DNV GL, September 2014

160 Table 1-2, page 1-5, Nonresidential Downstream Lighting Impact Evaluation Report, Itron, August 2014.

161 Page 19, 2013 Potential and Goals Study, Navigant, February 2014.

162 Page 138, 2013 Potential and Goals Study, Navigant, February 2014.

improving estimates of whether a technology is installed and operating, improved estimates of what the technology is replacing, and improved estimates of program free-ridership. But other nonresidential lighting technologies seem to be trending in the right direction. According to the California Commercial Market Share Tracking Study, the shares of reduced wattage T8 are increasing while the shares of older model T8 are decreasing.[163] Opportunities for lighting savings in the commercial sector should continue to be an area of attention.

Programs Will Need to Address Price and Availability Barriers for Replacement LEDs

Figure 7 shows the top seven LED technologies in the portfolio, but this finding is focused on two of those measures: LED Lamps and LED reflector lamps. The California Residential Replacement Lamp Market Status Report found 2 percent of all lamps stocked in 2012 and 2013 were LED replacement lamps and that the average price for LED replacement lamps were three times more expensive than other replacement lamp technologies at $15 per lamp.[164] Furthermore, the Measure Cost Study found the average incremental cost for LED replacement lamps, compared to both incandescent and CFLs are very high, $24-$33 for A-Lamps and $40-50/lamp for reflectors.[165] And while LED prices are decreasing, they might not be "universal across products types or channels", for example, LED reflector lamps decreased by $6.50 at big box stores but increased by roughly $1 at other retailers.[166] If California is to meet the vision of the Lighting Chapter for the Energy Efficiency Strategic Plan, and transform the lighting market with advanced lighting products, our programs should aggressively address the barriers to the LED replacement lamp market, so consumers are able to purchase and install high quality LEDs in their homes.

Halogen Market Presence and Installations Are Increasing

The phase-out of traditional incandescent lamps through federal and state regulations drove increases in the halogen lamp market between 2012 and 2013. The California Residential Replacement Lamp Market Status Report found a 40 percent increase in the percentage of stores stocking halogen lamps and the share of retail lamp stock of halogen lamps in California doubled.[167] The California Lighting and Appliance Saturation Survey found the percentage of lamps types found in homes are predominantly incandescent at 49 percent[168] followed by CFLs at 28.5 percent; however, halogens make up almost 8 percent, an increase of 103 percent from the 2005 CLASS study.[169] While the intended effect of the federal and state legislation is to move consumers away from incandescent bulbs, this is a challenge to the California Long Term Energy Efficiency Strategic Plan to transform the lighting market with advanced lighting technologies as opportunities to LED replacement may be driven by these other less expensive base technologies available to consumers.

163 Figure 4-4, Page 4-16, California Commercial Market Share Tracking Study, Itron, July 2014
164 Page 166, California Residential Replacement Lamp Market Status Report: Upstream Lighting Program and Market Activities in California Through 2013, DNV GL, September 2014
165 Page 3-25, Measure Cost Study, Itron, June 2014.
166 Page 4, LED Lighting Market Baseline Characterization: Phase I Market Effects Study of IOU Programs, DNV GL, July 2014
167 Page 168, California Residential Replacement Lamp Market Status Report: Upstream Lighting Program and Market Activities in California Through 2013, DNV GL, September 2014
168 These percentages use the strata weights limited to 2005 CLASS types rather than the census weights, for comparison purposes.
169 Page 4-14, California Lighting and Appliance Saturation Study, DNV GL, June 2014

Advanced Controls Have a Place in Increasing Energy Savings in the Nonresidential Lighting Market

In Figure 8, two percent of the portfolio electric savings come from some type of control, with wall or ceiling mounted occupancy sensors being the largest contributor. The Nonresidential Downstream Lighting Impact Evaluation report found a gross realization rate of 57 percent for this measure, partially due to inaccuracies of the identified controlled wattage[170]. However, the LED Lighting Market Baseline Characterization Report suggests "structuring incentives to favor inclusion of controls in the installation" could increase nonresidential energy savings and overall LED cost effectiveness.[171] Now that the 2013 Building Energy Efficiency Standards include occupancy sensors and other controls[172], this suggests future programs will have to find innovative advanced and integrated control strategies to capture more savings from lighting technologies.

For More Information

Findings from evaluation results included in this chapter and studies related to several lighting programs may be found at www.calmac.org and www.energydataweb.com/cpuc/ . These studies are listed below:

Completed Studies:

- Advanced Lighting Baseline Study: Phases 1 and 2 http://www.energydataweb.com/cpucFiles/pdaDocs/771/Lighting_Statewide%20Advanced%20Lighting%20Market%20Baseline%20Study%20Phase%202a%20SOW.pdf
- Assessment of the Early Effects of EISA and AB 1109 in California http://www.calmac.org/publications/Early_Effects_of_EISA_and_AB1109_Report_-_FINAL.pdf
- California Commercial Market Share Tracking Study http://www.energydataweb.com/cpucFiles/pdaDocs/1158/California%20Commercial%20Market%20Share%20Tracking%20Study_Report%20and%20Appendices_Final%20(1).pdf
- California LED Lamp Market Characterization Report http://www.energydataweb.com/cpucFiles/92/LEDMarketCharacterization_1.pdf
- California Residential Replacement Lamp Market Characterization Report http://www.energydataweb.com/cpucFiles/pdaDocs/1147/140804%20WO13%20CA%20Res%20Ltg%20Mkt%20Status%20Report%20-%20DRAFT.pdf
- Commercial Market Saturation Survey http://www.energydataweb.com/cpucFiles/pdaDocs/1159/California%20Commercial%20Saturation%20Study_Report_Final.pdf
- Fall 2011 California Lighting Retail Store Shelf Survey Report http://www.energydataweb.com/cpucFiles/92/CaliforniaLightingRetailStoreShelfSurveyReport_3.pdf
- LED Lighting Market Effects Study of Investor-Owned Utility Programs to Support LED Lighting In California http://www.energydataweb.com/cpucFiles/pdaDocs/1134/LED_market_baseline_and_effects_study_final.pdf
- Lighting Activity Workbook Phase II Final Report and Spreadsheet http://www.energydataweb.com/cpucFiles/pdaDocs/1098/

170 Page 6-5, Nonresidential Downstream Lighting Impact Evaluation Report, Itron, August 2014.
171 Page 14, LED Lighting Market Baseline Characterization: Phase I Market Effects Study of IOU Programs, DNV GL, July 2014
172 2013 Building Energy Efficiency Standards, CEC, May 2012 at http://www.energy.ca.gov/title24/2013standards/index.html

Lighting%20Activity%20Workbook%20(LAW)%20Phase%20II%20FINAL.zip

- Lighting Market Transformation Workbook http://www.energydataweb.com/cpucFiles/pdaDocs/828/LMT%20Workbook%20Final%20Report%202-24-12.pdf
- Measure Cost Study http://www.energydataweb.com/cpucFiles/pdaDocs/1100/2010-2012%20WO017%20Ex%20Ante%20Measure%20Cost%20Study%20-%20Final%20Report.pdf
- Nonresidential Downstream Lighting Impact Evaluation http://www.energydataweb.com/cpucFiles/pdaDocs/1155/Nonresidential%20Downstream%20Lighting%20Impact%20Eval%20Final%20Report.zip
- Residential/Advanced/Upstream Lighting Impact Evaluation http://www.energydataweb.com/cpucFiles/pdaDocs/1151/WO28%20California%20Upstream%20and%20Residential%20Lighting%20Impact%20Evaluation%20Final%20Report.zip
- SDG&E 2010-2012 Residential Program Process Evaluation http://www.energydataweb.com/cpucFiles/topics/65/SDGE%20SOW%20for%20CMS.pdf
- The Southern California Edison (SCE) Advanced Light Emitting Diode (LED) Ambient Lighting Program Customer Preference and Market Pricing Trial http://www.lightingmarkettransformation.com/wp-content/uploads/2013/02/The-SCE-Advanced-Ambient-LED-Trial-Study-Final-Report-12-31-12.pdf

Financing

Overview

Financing has been identified as an important tool for California to meet its energy efficiency goals. Financing can support the purchase and installation of comprehensive, qualified energy efficiency measures by removing the up-front cost barriers. Per direction from the CPUC, California's IOUs offered on bill financing (OBF) to nonresidential customers as part of the 2010-2012 program cycle.

Financing is playing a larger role in the 2013-2014 program cycle, with the 2013-2014 portfolio budget decision authorizing $100 million for financing pilots including those administered by local government Regional Energy Networks, and those originally funded by ARRA - as well as $114 million for OBF. These pilots use ratepayer funds to leverage private finance through credit enhancements – unlike OBF, which uses ratepayer funds for the loans. This new approach seeks to allow the scale of financing of energy efficiency in California to grow beyond what ratepayers can fund directly, as well as to expand the availability of financing to residential and non-residential customers who are currently unable to access such funds. More information on early findings will be available in the upcoming year.

On bill financing was classified as a non-resource program in the 2010-2012 program cycle, which means the program is not required to report energy savings. The budget for OBF activities in the 2010-2012 program cycle was approximately 3 percent of the portfolio. Unlike other programs in the portfolio, customers return a large fraction of the program spending in the form of loan repayments.

Programs

In the OBF program, eligible customers applying for energy efficiency program rebates or incentives can finance the balance of their project costs using an OBF loan at zero percent interest. Loan installments are then included as a line item on the utility bill. Minimum loans are $5,000 and the maximum loan varies by customer type and utility. OBF loans are designed to be bill neutral, meaning that monthly payments are not expected to exceed projected monthly energy savings. Loan terms are calculated using the total project cost and the projected monthly energy savings, with a maximum term of five years for commercial, industrial and agricultural customers, and 10 years for tax-payer funded institutions.

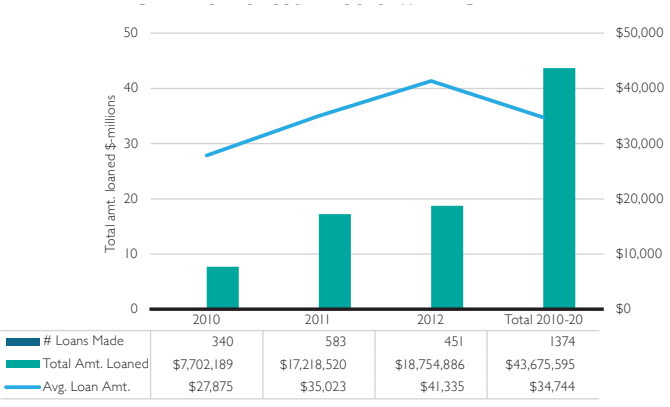
On-bill financing is a revolving loan pool.[173] With OBF, as loans are repaid on a monthly basis, the IOUs are able to commit to and make additional loans using the loan pool. Given that SDG&E began lending in 2006, it is expecting to soon be in a position where repayments on the $28.7 million it has loaned since then will equal new loans it makes. As of the end of 2012, $49 million in loans were issued statewide. The loan pool amount for SoCalGas and SDG&E includes balances due on all loans issued as of December 31, 2012, plus committed loan amount as of the same date. This figure reflects a point in time and will vary day to day as loans are committed to and paid back. For PG&E and SCE, the loan pool amount is the CPUC-authorized funding level for loans. The CPUC authorized an additional $91,700,000 for the 2013-2014 program cycle.

Table 25. Loan Pool by IOU and Statewide

	Loan Pool Size as of 12/31/2012	2013-2014 New Loan Pool Funding	Total Loan Funding as of 2013-2014
PG&E	$18,585,014	$32,000,000	$50,585,014
SCE	$36,800,000	$43,724,863	$80,524,863
SDG&E	$20,870,445	$14,000,000	$34,870,445
SoCalGas	$1,908,730	$2,000,000	$3,908,730
Statewide	$78,164,189	$91,724,863	$169,889,052

The average loan size and the sector loaned to varied by IOU. For instance, SDG&E made more than twice the number of loans as any other IOU, with a smaller average loan amount. SCE loaned more to taxpayer funded institutions, while the majority of PG&E's loans were made to commercial customers. PG&E and SCE loans acquired roughly 2.2 kWh in expected energy savings per dollar loaned whereas SDG&E's acquired nearly twice as much — slightly more than 4 kWh per dollar loaned.[174]

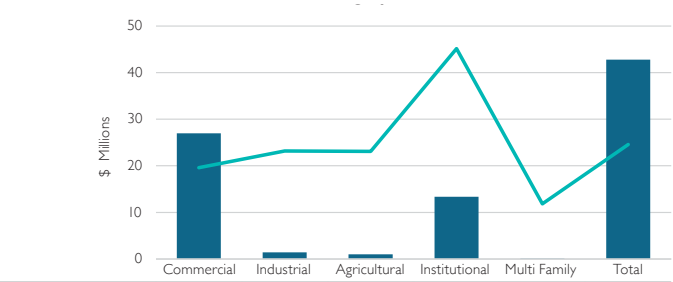
Figure 9. OBF Loans Issued Statewide, 2010-2012



173 SCE's loan pool operates as revolving loan pool within each program cycle. Unspent, uncommitted OBF funds at the end of 2012 were returned to ratepayers.

174 This calculation does not take into account the therm savings the projects funded (95,381 at PG&E, and 262,908 at SDG&E)

Figure 10. Statewide Lending by Market, 2010-2012



	Commercial	Industrial	Agricultural	Institutional	Multi Family	Total
% of Total Amount	63%	3%	7%	31%	0.1%	105%
Amount Loaned	$26,968,715	$1,438,677	$986,223	$13,354,361	$49,765	$42,797,740
% of Total Number	76%	6%	2%	16%	0.2%	100%
Number of Loans	1050	79	24	218	3	1374
Average Loan Size	$27,433	$32,476	$32,341	$63,195	$16,588	$34,407

Figure 11. Energy Efficiency Measures funded by OBF, 2010-2012

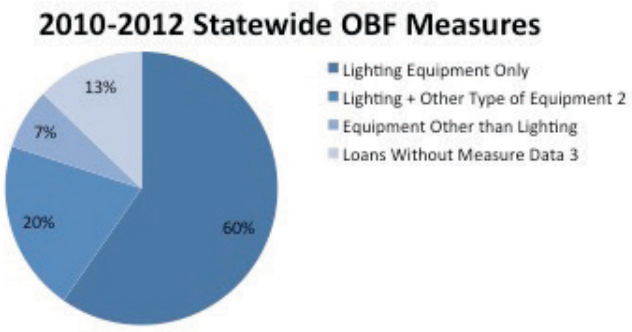


Table 26. Cumulative Loan Defaults and Partial Payments through 2012

IOU	Number of Defaults	Total Amount Defaulted	% of Defaulted Amount over Total Issued Loan Amount	Market Segment	Number of Loans with Missed Payments that Are Not in Default
PG&E	0	0	0%	-	Do Not Track
SCE	1	$9,749	0.104%	Commercial	30
SDG&E*	16	$239,285	0.83%	CIA Small, Commercial, Agriculture	Do Not Track
SoCalGas	1	1,271	.08%	Agricultural	Do Not Track
Total	18	$250,305.37	0.51%	Commercial, CIA Small, Agriculture	30

**SDG&E and SoCalGas default statistics are cumulative to 2006. SDG&E has made three times more loans than any other IOU*

OBF predominantly funded lighting measures. The CPUC is considering a proposal to cap at 20 percent the percent of total project costs financed by OBF that can by comprised of standard lighting measures, for business customers, with exclusions for certain types of advanced lighting.[175]

Highlights

There has been an extremely low default rate across the utilities (less than 1 percent), in part due to strict underwriting criteria and the "newness" of the OBF programs. For instance, by the end of 2011, PG&E had only made 13 loans.

Statewide finance programs are categorized as resource programs in 2013 and 2014. New financing programs are proposed statewide including credit enhancements for single-family homes; credit enhancements and on bill repayment (OBR) for multifamily properties; credit enhancements for small business; and, OBR for all non-residential customers.

Findings

No evaluations were performed of this sector in 2012. However, the IOUs conducted market research to support the design of new finance programs, conducting focus groups, lender interviews etc., in late 2012 and early 2013.[176] Market research found that:

- Focus groups revealed that potential customers of all types are limited in their familiarity with finance offerings for energy efficiency projects.
- Program sponsors, contractors and others working with customers will face questions about financing and loans.
- Additionally, customers may not perceive that contractors are to be trusted as messengers about loan products.
- Among medium and large business customers there is a lack of appeal and understanding of the advantages of on-bill repayment.
  - Face-to-face discussions with a knowledgeable and trusted source such as an IOU representative or a local lending institution seem to be required for gaining organizational support for projects;
  - Customers need to understand the benefits of attractive terms, the broad availability of energy efficient equipment covered, inclusion of rebates, and the energy savings projected to offset of loan payments.
- Small business customers found value in the on-bill repayment feature.
  - They will appreciate caps on interest rates and fees, as well as the inclusion of rebates and realization of energy savings to offset loan payments (similar to the medium and large business sector).

Single Family homeowners cited interest rates as a critical criterion in decision-making. Finance program administrators will be challenged to differentiate 3 key issues for homeowners:

175 "Lighting + Other Type of Equipment 2": % of loans that implemented at least one lighting and at least one non-lighting measure "Equipment Other than Lighting" includes: appliances, HVAC, boilers and steam systems, industrial systems, cross portfolio, motors, electronics and IT, refrigeration, food service technology, building shell, pumps and fans, and energy management systems. N = 1,374 measures

176 See "Energy Efficiency Financing Customer Research Focus Groups Findings," June 2013, Pacific Gas & Electric, by The Cadmus Group, Inc. (note: part of a large project that will be posted on CALMAC by 12/31/14).

- the interest rate for an unsecured energy efficiency loan supported with a credit enhancement, from
- homeowners' expected interest rates which are based on subsidized loans such as car loans, and ARRA funded loans, and
- secured loans such as home mortgages, and home equity lines of credit.

Decision-makers from the multifamily apartment building sector need approval for loans from their investors/owners, who may be numerous, and widespread in location. Non-profits need staff time required to apply for the loan and manage the energy upgrade project to be covered by the loan.

For More Information

Studies related to finance programs may be found at www.calmac.org and www.energydataweb.com/cpuc/.

Completed Studies:

- Energy Efficiency Financing Customer Research Focus Groups Findings, June 2013

Energy Efficiency Potential and Goals

The 2013 Energy Efficiency Potential and Goals Study provides a forecast of the available energy efficiency potential for the majority of energy end uses across California's four investor owned utilities (IOUs). The study is used to establish savings goals for the IOUs to achieve, as well as to set the forecast for energy efficiency as a resource in the Long Term Procurement Planning process and as its contribution toward California's greenhouse gas reduction targets.

The Potential and Goals Study develops a forecast by applying the results of previous studies—including impact evaluations, measure cost studies, baseline studies and market assessments—to model a forward outlook of energy efficiency potential. The Study does this by calculating three types of potential:

- **Technical Potential:** represents the total energy savings available each year that are above the baseline of the Title 20/24 codes and federal appliance standards if all technically applicable opportunities to improve energy efficiency were taken, including retrofit measures, replace-on-burnout measures, and new construction measures.
- **Economic Potential:** calculates the subset of technical potential available when limited to only cost-effective measures.
- **Market Potential:** calculates the energy efficiency savings expected to be adopted by the market in response to specific levels of incentives and assumptions about market influences and barriers.

Expanding upon previous potential studies, the 2013 Study models energy savings generated from financing initiatives, a more comprehensive list of emerging technologies, a new approach to the industrial and agricultural sectors, and the inclusion of whole building programs in addition to the standard IOU rebate programs. These new initiatives are anticipated to increase energy savings by 16 percent in 2024 over the previous potential study produced in 2011.

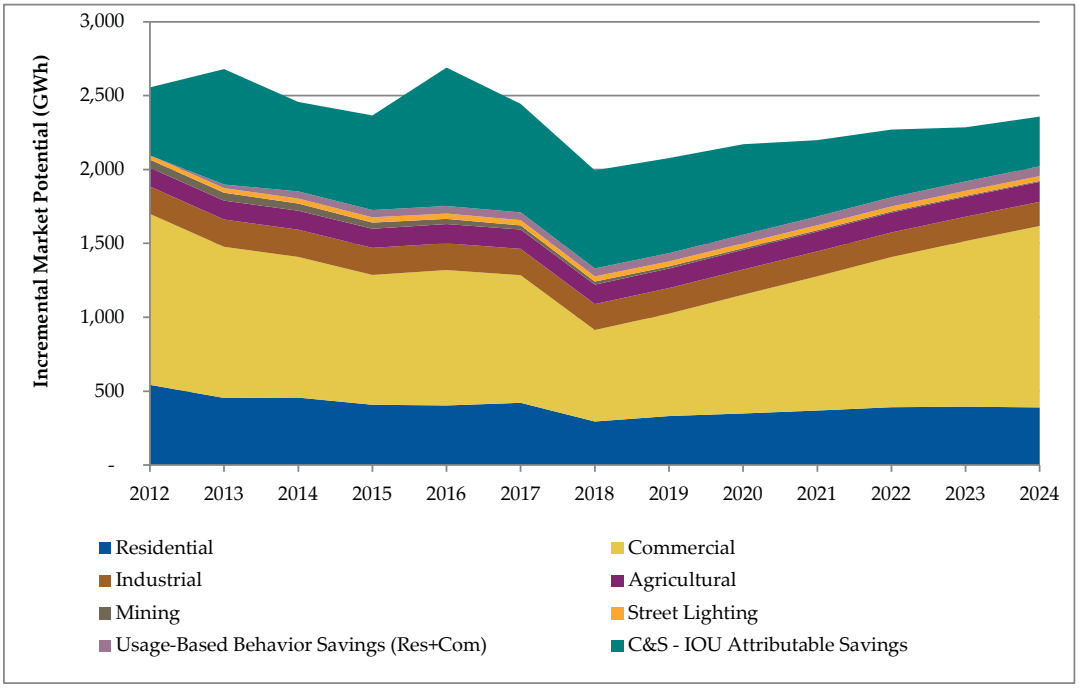
The results of the Potential Study forecast that California will achieve 27,300 GWh in cumulative energy savings by 2024 from IOU rebate programs and 9,300 GWh in cumulative savings from the adoption of codes and standards updates.[177] The reductions in the demand forecast for procurement planning are based on cumulative market potential.[178]

The Potential and Goals Study also identifies incremental market potential, which represents the annual energy savings produced by all energy efficiency measures installed in a single program year. Incremental market potential is important for establishing the energy savings goals that the IOUs are expected to achieve. The results of the study show that the commercial sector will provide the largest and only expanding source of energy savings beyond 2018, providing over 1,200 GWh of incremental annual savings by 2024. The results also indicate that savings from the IOU's Codes and Standards advocacy programs will peak in 2016 at 940 GWh, and then contribute a decreasing level of savings after 2018, as the lighting standards have been fully implemented.

177 Codes and standards forecast savings represent the net forecast caused by IOU advocacy efforts. The gross savings is forecasted to be 38,650 GWh.

178 Cumulative market potential is adjusted to redundancies in the demand forecast from naturally occurring savings, Achievable Energy Savings Forecast produced by the CEC.

Figure 12. Incremental Annual Market Potential by Sector

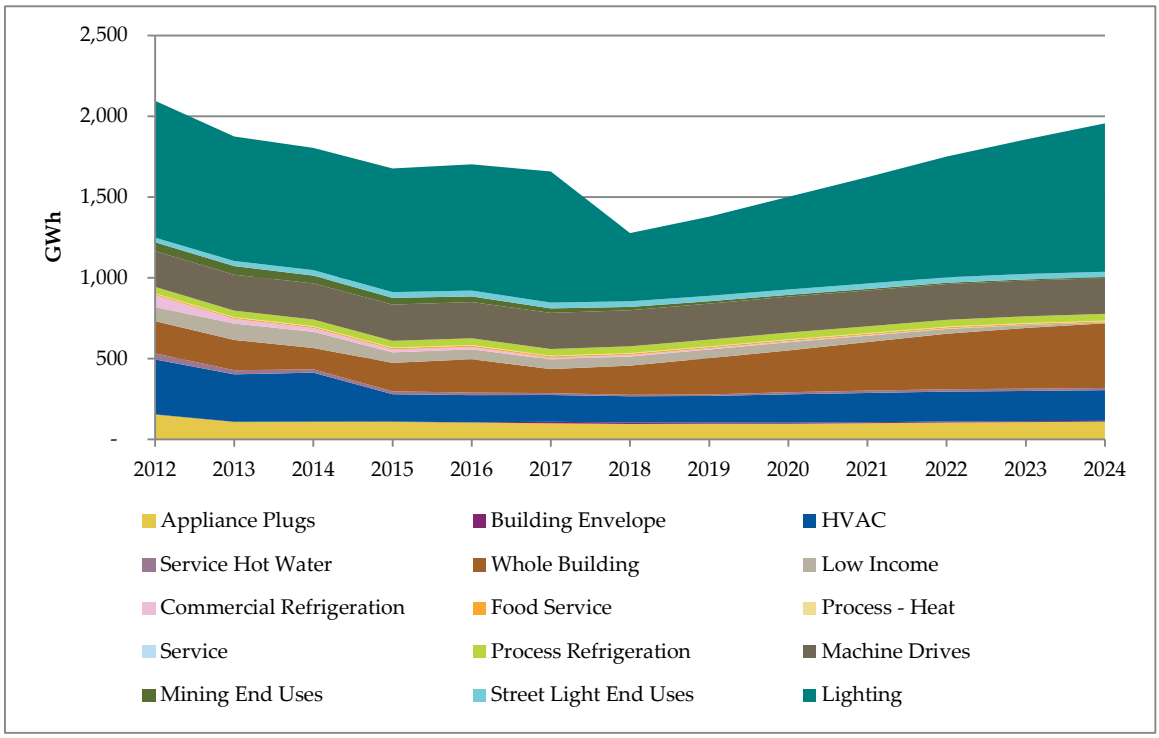


The 2013 Potential and Goals study provided a new approach to the assessment of the agricultural and industrial sectors, and added mining and street lighting to the potential forecast. These sectors identified 338 GWh in additional potential by 2024, as shown in Figure 12. Incremental Annual Market Potential by Sector11.

The study identified incremental energy savings that will be produced by each end use, illustrated in Figure 13. All IOU All Sectors Incremental Electric Savings by End Use12. Lighting will continue to be a dominant source of energy savings, although at a smaller level than it has been for the previous portfolio cycles. In recent years, IOU-claimable savings from basic CFLs have decreased as standards established by AB1109 (The Lighting Efficiency and Toxics Reduction Act; i.e. "the Huffman bill"), have been adopted for lighting. By 2018, energy savings from CFLs will decline to 38.3 GWh annually, down from its peak at 1,628 GWh in 2009. After 2018, however, light-emitting diodes (LEDs) will become the primary driver of savings in the lighting end use.

Figure 13. All IOU All Sectors Incremental Electric Savings by End Use12 also illustrates the projected impact of whole building initiatives, which is the other growing source of energy efficiency potential. In 2012, whole building initiatives were estimated to have produced 200 GWh of savings, and by 2024 these efforts are projected to produce 400 GWh.

Figure 13. All IOU All Sectors Incremental Electric Savings by End Use



2013–2014 Energy Efficiency Activities

2013-2014 Energy Efficiency Program Activities

In December 2012, the CPUC issued Decision 12-11-015 (D.12-11-015), which approved a $1.9 billion portfolio of energy efficiency programs for 2013-2014.[177] The decision also identified and clarified the roles of two new entities to the energy efficiency program implementation sphere - regional energy networks (RENs) and community choice aggregators (CCAs). The RENs and CCAs were created to complement the IOUs' energy efficiency programmatic efforts and address any gaps in those efforts.

Consequently, in 2013-2014 the IOUs were joined in their program administrator efforts by the San Francisco Bay Area Regional Energy Network and Southern California Regional Energy Network and the Marin Energy Authority.

The programs approved in D.12-11-015 were largely an extension of programs in place for the 2010-2012 program cycle and focused on the sectors described in this report.

2013-2014 Energy Efficiency Program Evaluation Activities

In D.12-01-015, the CPUC authorized an evaluation budget equal to four percent of the total approved budget for IOU, REN and CCA program activities. The $76 million in evaluation funds was divided between the CPUC and IOUs, each of whom is responsible for a certain set of evaluation projects. As was the case in 2010-2012, the CPUC is responsible

177 See D.12-11-015 at http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M034/K299/34299795.PDF

for evaluations to estimate energy savings from program activities, while both the CPUC and the IOUs lead studies such as process evaluations and market studies.

The CPUC and the IOUs worked together to develop and implement research plans for each of the specific program sectors described in other areas of this report. The long term plans considered evaluation work from prior program cycles and identified remaining questions for each of the sectors and research needs. Like 2010-2012, the suite of evaluations for the 2013-2014 cycle include a range of impact evaluations, process evaluations and market studies to gain a broad understanding of energy savings, program delivery and market conditions as a result of continued program efforts and add to the body of research accumulated since the beginning of the 2006-2008 program cycle.

As of December 2014, savings estimates from program activities are reported by the IOUs, meaning that they have not been evaluated by the CPUC and consequently do not reflect feedback from field analysis; nor do these reported savings provide the full picture of progress toward California's climate goals, long-term planning efforts, and other complementary energy policy needs. Evaluation results typically differ from, and are lower than, IOU reported savings. Understanding this difference is critical to determining the direct influence of energy efficiency programs on participants, as a portion of savings will occur naturally in the absence of programmatic efforts.

2013-2014 Efficiency Savings Performance Incentive

In September 2013, the CPUC issued Decision 13-09-023, which established the Efficiency Savings Performance Incentive (ESPI). The ESPI, like the Risk Reward Incentive Mechanism (RRIM) which it replaced, promotes the achievement of energy efficiency goals via the IOUs' programmatic efforts and highlights the role of energy efficiency as the highest energy resource priority to meet California's energy demand.

Like the RRIM, the ESPI awards incentives to the IOUs for reaching specific energy savings goals. However, the ESPI differs from the RRIM in that it replaces the formula for determining overall performance vis a vis energy savings goals with a mechanism that is "more transparent, streamlined, and less controversial."[178] The ESPI performance awards are based on four performance areas: 1) energy efficiency resource savings; 2) IOU ex-ante performance; 3) building codes and standards energy efficiency programs; and 4) non-resource programs, with the largest share of incentives awarded for achievement of energy efficiency resource savings. Each incentive performance area includes an incentive cap tied to program expenditures.

The ESPI mechanism applies to energy efficiency program activity that commenced on January 1, 2013 (the beginning of the 2013-2015 program cycle). Decision 13-09-023 includes the schedule and processes for the review and approval of incentive awards. As of the publication of this report, full incentive awards have not yet been made for prior program years.

178 See R.09-01-019 at 4-5

However, the ESPI award schedule calls for a resolution for full incentive payments regarding ESPI achievements by the end of 2015 and each year thereafter.

Appendix A: IOU Savings Compared to CPUC Savings Goals

This appendix compares the energy savings reported by the IOUs and the evaluated energy savings achievements for the 2010-2012 program cycle with the energy savings goals adopted by the Commission in D.09-09-047. The following terms describe different metrics used by the Commission in establishing goals and defining savings impacts:

- **Goals**[1] - Energy savings targets established by the Commission for IOU programs in the 2010-2012 program cycle. These goals were set for the program cycle. The current goals are based on historic energy efficiency savings assumptions that were available from potential studies conducted at the time.
- **Projected Savings** – Energy savings proposed by the IOUs and filed with the Commission via portfolio applications. Projected savings reflect planned program activity prior to program implementation, and they have historically exceeded adopted goals.
- **Utility Reported Savings** - Also referred to as "claims," these are energy savings claimed by the utilities and based on the number of installed technologies and pre-evaluation (***ex ante***) savings assumptions.
- **Evaluated Savings** - Energy savings estimates that represent adjustments to the Utility Reported Savings based on field research of the installations, performance and market conditions gathered during evaluation activities.
- **Gross Impacts** - Energy savings that result from efficiency measures installed / actions taken by utility customers, regardless of whether or to what extent the programs influenced their actions.
- **Net Impacts** - Energy savings directly attributable to the program. Net savings are calculated by subtracting savings by program participants that are estimated to have happened without the program (so called "free ridership") from the gross savings estimate.

The Commission sets IOU energy savings goals based on market potential studies for energy efficiency technologies and programs. The energy savings goals for the 2010-2012 energy efficiency portfolios were originally established in D.04-09-060. In that decision, the Commission adopted savings targets for each of the utilities for the years 2004-2013 that reflect the expectation that energy efficiency efforts in their combined service territories should be able to capture 70% of the economic potential and 90% of the maximum achievable potential for electric energy savings over the 10-year period. Savings goals were defined as cumulative in D.04-09-060, reaffirmed

1 The goals that are currently in place were adopted in D. 04-09-060; September 23, 2004, were based on the data available at the time; and were considered "stretch goals." http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/40212.pdf

in D.07-10-032, and adjusted to an annual basis in D.09-05-037.

For the 2010-2012 program implementation period, the Commission allowed the utilities to credit savings from Low Income Energy Efficiency programs and Codes and Standards advocacy toward their goals, although these savings were not included in the savings potential study used to define the goals. Looking just at evaluated gross IOU program savings, excluding Codes and Standards advocacy and low income program savings, the statewide goals for electricity and natural gas savings were exceeded by 11 percent and 15 percent, respectively, while the achievement of goals set for demand reduction fell short by 15 percent (Table A-1 Energy Savings for Statewide 2010-2012 Portfolio: Goals, Reported, Evaluated.) With the inclusion of savings from Codes and Standards advocacy and low income programs, the utilities exceeded the statewide 2010-2012 electric gross savings goals by 47 percent; the demand goals by 11 percent; and the natural gas goals by 32 percent.

It is important to acknowledge several challenges associated with a comparison of goals and evaluated savings. Each savings estimate is based on slightly different assumptions and available information in different time periods. The primary difference is that evaluated results reflect newly attained information on energy efficiency market penetration, end user adoption rates, and per unit savings levels developed through on-site evaluations and other research. This information was not available when goals or ex ante savings estimates were established. This leads to differences between the savings estimates assessed after implementation and forecasted savings potential and savings estimates used to develop the efficiency goals.

The following tables present the range of savings estimates including the final evaluated savings in comparison to the savings goals the Commission adopted for the program cycle (2010-2012).

Table A-1 Energy Savings for Statewide 2010-2012 Portfolio: Goals, Reported, Evaluated

		Energy Savings		
		Electric (GWh)	**Demand (MW)**	**Natural Gas (MM Therms)**
Goals	Gross	6,966	1,537	150
Reported	Gross	9,167	1,657	155
	Net	6,416	1,177	102
Evaluated	Gross	7,745	1,308	173
	Net	4,923	844	94
Codes and Standards	Net	2,281	343	11
Evaluated Savings Including Codes and Standards		10,026	1,651	184
Low Income	Reported	237	59	14
Evaluated Including C&S and Low Income		10,263	1,710	197
Evaluated Gross Savings V. Goals		111%	85%	115%
Evaluated Gross, C&S and Reported LI V. Goals		147%	111%	132%

Table A-2 2010-2012 Energy Savings PG&E: Goals, Reported, Evaluated

		PG&E Energy Savings		
		Electric (GWh)	**Demand (MW)**	**Natural Gas (MM Therms)**
Goals		3,110	703	49
Reported	Gross	3,924	703	68
	Net	2,701	487	43
Evaluated	Gross	3,256	553	53
	Net	1,999	345	27
Codes and Standards	Net	1,004	131	(1)
Evaluated Including Codes and Standards	Net(C&S), Gross(Programs)	4,260	684	52
Reported	Low Income	135	34	6
Evaluated Including C&S and Low Income	Net(C&S), Gross(Programs), Low Income (Reported)	4,395	718	59
Evaluated Gross Savings vs. Goals		105%	79%	109%
Evaluated Gross, C&S and Reported LI V. Goals		141%	102%	120%

Table A-3 Reported and Evaluated - SCE

SCE Energy Savings

		Electric (GWh)	Demand (MW)	Natural Gas (MM Therms)
Goals		3,316	727	-
Reported	Gross	4,458	825	-
	Net	3,169	598	-
Evaluated	Gross	3,859	652	-
	Net	2,541	437	-
Codes and Standards	Net	1,042	174	-
Evaluated Including Codes and Standards	Net(C&S), Gross(Programs)	4,901	826	-
Reported	Low Income	78	23	-
Evaluated Including C&S and Low Income	Net(C&S), Gross(Programs), Low Income (Reported)	4,979	849	-
Evaluated Gross Savings V. Goals		116%	90%	
Evaluated Gross, C&S and Reported LI V. Goals		150%	117%	

Table A-4 Reported and Evaluated SCG

SCG Energy Savings

		Electric (GWh)	Demand (MW)	Natural Gas (MM Therms)
Goals		-	-	90
Reported	Gross	-	-	83
	Net	-	-	55
Evaluated	Gross	-	-	111
	Net	-	-	62
Codes and Standards	Net	-	-	12
Evaluated Including Codes and Standards	Net(C&S), Gross(Programs)	-	-	123
Reported	Low Income	-	-	6
Evaluated Including C&S and Low Income	Net(C&S), Gross(Programs), Low Income (Reported)	-	-	129
Evaluated Gross Savings V. Goals				123%
Evaluated Gross, C&S and Reported LI V. Goals				143%

Table A-5 Reported and Evaluated SDG&E

SDG&E Energy Savings		Electric (GWh)	Demand (MW)	Natural Gas (MM Therms)
Goals		540	107	11
Reported	Gross	786	129	4
	Net	546	92	3
Evaluated	Gross	630	103	9
	Net	383	63	5
Codes and Standards	Net	235	39	(0)
Evaluated Including Codes and Standards	Net(C&S), Gross(Programs)	865	142	9
Reported	Low Income	24	2	1
Evaluated Including C&S and Low Income	Net(C&S), Gross(Programs), Low Income (Reported)	888	144	10
Evaluated Gross Savings V. Goals		117%	96%	80%
Evaluated Gross, C&S and Reported LI V. Goals		165%	134%	89%

Appendix B: Energy Savings by Sector and End Use

One way to understand the impact of portfolio savings on California is to explore where the savings have been realized. The proportion of savings by customer market sector and the total by utility are presented in this appendix. The majority of energy savings, both statewide and for each utility, is concentrated in the residential and commercial market sectors. Key end uses include HVAC and indoor lighting for electric savings and large industrial processes for natural gas savings.

The evaluations conducted in the 2010-2012 period considered all fuel impacts of the installed measures. For instance, the evaluations estimate the positive electric savings from reduced air conditioning load and negative natural gas savings from increased heating load that result from installation of more efficient interior lighting and refrigeration measures. Consequently, electric impacts are reflected for SCG and natural gas impacts are shown for SCE. These impacts are not considered compared to goals, since neither utility has goals for energy types it does not sell.

The savings estimates provided in this appendix reflect savings parameters that have been updated based on the evaluations summarized in this report. Appendix H provides a decision tree that illustrates how evaluation findings were used to update each parameter in the program tracking data.

Figure B-1. Distribution of Electric Savings by Sector

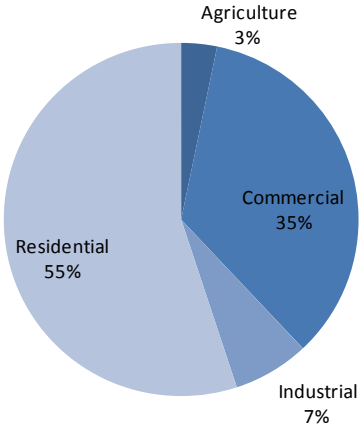


Figure B-2. Distribution of Natural Gas Savings by Sector

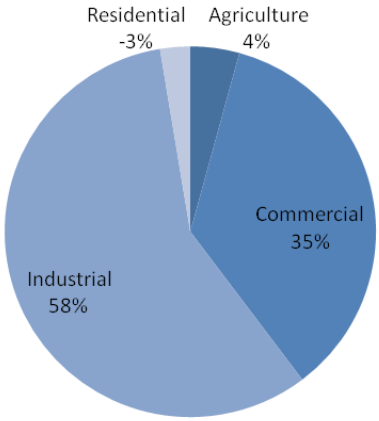


Table B-1 2010-2012 Energy Savings by Sector – Electricity and Gas

Peak Demand Savings (kW)

Target Sector	Reported Gross	Evaluated Gross	Reported Net	Evaluated Net
Agriculture	77,664	61,521	53,698	39,004
Commercial	831,401	488,802	611,998	307,503
Industrial	136,743	78,522	98,126	42,969
Residential	611,478	679,332	413,205	454,844
Total kW	**1,657,287**	**1,308,177**	**1,177,027**	**844,319**

Electric Savings (kWh)

Target Sector	Reported Gross	Evaluated Gross	Reported Net	Evaluated Net
Agriculture	340,373,030	262,000,192	227,568,388	146,830,240
Commercial	4,228,057,032	2,783,773,299	3,084,461,993	1,739,039,560
Industrial	838,166,105	558,780,666	586,560,934	293,507,891
Residential	3,760,774,247	4,140,600,320	2,517,101,785	2,743,708,604
Total kWh	**9,167,370,414**	**7,745,154,476**	**6,415,693,100**	**4,923,086,294**

Natural Gas Savings (Therms)

Target Sector	Reported Gross	Evaluated Gross	Reported Net	Evaluated Net
Agriculture	8,513,921	7,225,374	5,417,459	3,900,018
Commercial	50,635,171	60,281,460	30,888,826	30,186,042
Industrial	91,052,419	97,805,203	57,801,939	50,827,182
Residential	4,718,646	7,352,897	7,785,613	9,071,885
Total Therms	**154,920,156**	**172,664,934**	**101,893,837**	**93,985,126**

Table B-2 Energy Savings by IOU and Sector - Electricity and Gas

Energy/Demand Savings by IOU & Sector - Electricity and Gas, Reported & Evaluated

		Reported kW		**Evaluated kW**		**Reported kWh**		**Evaluated kWh**		**Reported Therms**		**Evaluated Therms**	
Sector	IOU	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
Agriculture	PG&E	56,775	39,571	45,405	29,189	227,474,809	152,024,757	175,740,003	96,686,268	8,182,735	5,205,500	6,711,566	3,643,318
	SCE	20,890	14,126	16,116	9,815	112,898,221	75,543,631	86,260,189	50,143,972	-	-	-	-
	SCG	-	-	-	-	-	-	-	-	331,187	211,959	513,808	256,700
	Total	77,664	53,698	61,521	39,004	340,373,030	227,568,388	262,000,192	146,830,240	8,513,921	5,417,459	7,225,374	3,900,018
Commercial	PG&E	342,180	242,491	211,010	128,579	1,857,176,688	1,328,858,028	1,248,091,245	758,059,952	24,921,599	14,144,944	23,116,555	10,784,092
	SCE	420,915	318,045	226,249	148,144	1,964,676,977	1,460,091,198	1,235,094,270	801,040,802	-	-	-	-
	SCG	-	-	-	-	-	-	-	-	21,133,689	13,695,677	30,149,289	15,746,599
	SDG&E	68,307	51,461	51,544	30,781	406,203,366	295,512,767	300,587,784	179,938,806	4,579,883	3,048,204	7,015,617	3,655,351
	Total	831,401	611,998	488,802	307,503	4,228,057,032	3,084,461,993	2,783,773,299	1,739,039,560	50,635,171	30,888,826	60,281,460	30,186,042
Industrial	PG&E	56,575	40,096	29,461	15,676	357,077,591	249,779,197	232,844,672	119,807,019	52,826,009	33,664,224	40,015,529	21,972,753
	SCE	74,282	53,824	44,710	24,920	441,312,044	309,099,705	298,515,473	159,501,733	-	-	-	-
	SCG	-	-	-	-	-	-	-	-	36,779,863	23,119,794	55,584,841	27,724,511
	SDG&E	5,886	4,206	4,351	2,372	39,776,471	27,682,033	27,420,520	14,199,138	1,446,547	1,017,921	2,204,833	1,129,918
	Total	136,743	98,126	78,522	42,969	838,166,105	586,560,934	558,780,666	293,507,891	91,052,419	57,801,939	97,805,203	50,827,182
Residential	PG&E	247,648	164,620	267,195	171,240	1,481,995,394	970,346,462	1,599,341,222	1,024,188,681	(18,176,562)	(9,750,461)	(16,618,458)	(9,086,737)
	SCE	308,671	212,145	365,126	253,954	1,938,796,049	1,323,807,261	2,239,377,731	1,530,378,472	-	-	-	-
	SCG	-	-	-	-	-	-	-	-	24,489,147	18,356,052	24,441,408	18,298,477
	SDG&E	55,160	36,439	47,011	29,650	339,982,804	222,948,062	301,881,367	189,141,452	(1,593,940)	(819,978)	(470,054)	(139,855)
	Total	611,478	413,205	679,332	454,844	3,760,774,247	2,517,101,785	4,140,600,320	2,743,708,604	4,718,646	7,785,613	7,352,897	9,071,885
Total		1,657,287	1,177,027	1,308,177	844,319	9,167,370,414	6,415,693,100	7,745,154,476	4,923,086,294	154,920,156	101,893,837	172,664,934	93,985,126

Note: Does not include C&S or Low Income data

Table B-3 Energy Savings by End Use – Electricity , Peak Demand and Natural Gas

Electric (kWh)

	Gross		Net	
End Use	Reported	Evaluated	Reported	Evaluated
Appliance	325,934,022	228,411,563	212,474,127	156,659,726
Food Service	14,128,437	14,122,434	9,895,784	9,889,960
HVAC	873,463,235	672,069,366	623,072,363	401,287,196
Indoor Lighting	5,644,658,802	4,894,651,131	3,968,939,320	3,147,450,338
Other	69,792,285	56,491,790	46,406,836	32,367,417
Outdoor Lighting	195,247,204	195,327,144	140,687,661	140,707,934
Plug Loads	334,126,069	330,543,986	221,283,936	217,497,869
Process	998,324,506	701,712,038	681,972,660	364,266,121
Refrigeration	451,739,682	402,872,172	314,273,645	262,234,551
Water Heating	3,403,999	3,097,297	2,336,359	1,956,459
Whole Building	256,552,172	245,855,556	194,350,409	188,768,722
Total	9,167,370,414	7,745,154,476	6,415,693,100	4,923,086,294

PeakDemand (kW)

	Gross		Net	
End Use	Reported	Evaluated	Reported	Evaluated
Appliance	68,412	50,028	45,357	34,804
Food Service	2,135	2,134	1,496	1,495
HVAC	225,823	191,247	161,549	130,349
Indoor Lighting	1,006,071	784,435	723,580	503,959
Other	7,465	6,932	5,031	4,025
Outdoor Lighting	3,900	3,900	2,678	2,678
Plug Loads	34,341	33,751	22,787	22,262
Process	158,556	109,290	109,324	63,100
Refrigeration	51,557	44,968	36,243	29,776
Water Heating	1,120	1,087	772	743
Whole Building	97,908	80,405	68,210	51,130
Total	1,657,287	1,308,177	1,177,027	844,319

	Natural Gas (Therms)			
	Gross		Net	
End Use	Reported	Evaluated	Reported	Evaluated
Appliance	7,035,291	7,399,364	5,797,515	6,019,447
Food Service	1,858,933	1,900,062	1,298,258	1,308,334
HVAC	30,374,711	30,953,060	21,856,502	18,262,183
Indoor Lighting	(41,804,676)	(35,792,073)	(27,413,444)	(22,968,128)
Other	10,926,772	13,594,930	7,403,682	7,905,660
Outdoor Lighting	(27,260)	(27,260)	(21,427)	(21,427)
Plug Loads	(2,293,064)	(2,293,064)	(1,466,155)	(1,466,155)
Process	107,615,677	113,159,911	68,602,485	59,495,574
Refrigeration	458,404	485,711	329,726	313,495
Water Heating	22,314,495	22,322,247	16,069,360	16,018,111
Whole Building	18,460,872	20,962,045	9,437,336	9,118,032
Total	154,920,156	172,664,934	101,893,837	93,985,126

Table B-4 Energy Savings by End Use and Sector - Electricity and Gas

		Electric (kWh)				Demand (kW)				Natural Gas (MMTherms)			
		Gross		Net		Gross		Net		Gross		Net	
Sector	End Use	Rpt	Eval	Rpt	Eval	Rpt	Eval	Rpt	Eval	Rpt	Eval	Rpt	Eval
Agriculture	Appliance	188,236	172,391	119,311	109,311	38	35	23	21	2,822	2,945	1,381	1,450
	Food Service	52,855	52,855	36,999	36,999	15	15	11	11	49,194	49,194	34,436	34,436
	HVAC	5,691,961	3,895,042	3,680,534	1,966,942	638	431	417	230	149,240	111,899	125,361	62,293
	Indoor Lighting	12,398,452	9,054,973	9,270,899	6,133,128	1,465	779	1,125	505	-	-	-	-
	Other	261,365	176,262	167,274	87,478	17	11	11	5	-	-	-	-
	Outdoor Lighting	4,228,928	4,229,338	2,982,186	2,982,334	322	322	253	253	-	-	-	-
	Process	247,983,686	191,553,303	168,785,312	110,824,280	67,972	55,404	47,447	35,917	7,582,301	6,171,030	4,930,075	3,453,755
	Refrigeration	68,435,268	51,890,799	41,974,449	24,314,542	6,699	4,062	4,228	1,916	74,373	55,765	47,599	31,044
	Water Heating	-	-	-	-	-	-	-	-	26,456	22,385	18,421	12,113
	Whole Building	1,132,279	975,228	551,424	375,227	498	463	184	146	629,535	812,157	260,186	304,926
	Total	340,373,030	262,000,192	227,568,388	146,830,240	77,664	61,521	53,698	39,004	8,513,921	7,225,374	5,417,459	3,900,018
Commercial	Appliance	19,395,933	18,091,413	13,950,975	12,980,555	1,663	1,414	1,088	904	667,247	674,029	504,560	508,710
	Food Service	13,947,187	13,941,184	9,768,909	9,763,085	2,097	2,095	1,469	1,468	1,675,182	1,677,007	1,173,895	1,174,342
	HVAC	767,608,281	585,759,132	549,797,954	348,177,040	161,663	129,435	115,503	86,559	17,482,066	17,060,635	12,777,073	9,328,182
	Indoor Lighting	2,434,032,545	1,324,306,829	1,819,421,255	842,527,735	524,587	246,143	397,370	156,482	(7,166,307)	(4,202,191)	(5,315,988)	(2,710,178)
	Other	37,336,834	26,631,621	24,138,868	12,853,532	3,437	2,983	2,218	1,394	7,194,630	9,356,355	4,807,735	5,224,596
	Outdoor Lighting	146,786,214	146,865,743	104,938,943	104,959,068	3,333	3,333	2,264	2,264	(26,483)	(26,483)	(20,766)	(20,766)
	Plug Loads	88,212,625	84,635,500	61,467,416	57,685,997	9,573	8,984	6,676	6,153	(142,463)	(142,463)	(99,450)	(99,450)
	Process	209,033,296	141,778,895	143,358,781	70,047,610	24,551	14,669	16,833	7,443	15,455,399	18,563,730	9,883,948	9,699,216
	Refrigeration	371,152,637	342,742,116	264,250,019	233,846,217	43,382	39,995	31,010	27,411	384,036	429,951	282,131	282,455
	Water Heating	915,059	657,715	649,677	317,562	200	181	136	118	3,487,701	3,519,417	2,190,385	2,164,883
	Whole Building	139,636,420	98,363,150	92,719,195	45,881,159	56,916	39,568	37,431	17,308	11,624,163	3,371,474	4,705,304	4,634,053
	Total	4,228,057,032	2,783,773,299	3,084,461,993	1,739,039,560	831,401	488,802	611,998	307,503	50,635,171	60,281,460	30,888,826	30,186,042

Table B-4 Energy Savings by End Use and Sector - Electricity and Gas continued

		Electric (kWh)				Demand (kW)				Natural Gas (MMTherms)			
		Gross		Net		Gross		Net		Gross		Net	
Industrial	Appliance	210,227	198,307	146,698	138,865	23	21	14	12	1,655	1,904	753	904
	Food Service	128,395	128,395	89,877	89,877	23	23	16	16	134,558	173,862	89,927	99,556
	HVAC	55,258,669	38,344,086	37,018,603	19,362,872	6,552	4,709	4,354	2,499	3,776,659	4,821,611	2,540,166	2,464,781
	Indoor Lighting	211,491,886	128,475,721	160,133,758	77,930,377	60,323	31,529	46,327	19,332	(402,565)	(184,949)	(308,096)	(110,866)
	Other	8,202,207	5,794,362	5,259,224	2,693,561	754	686	485	319	913,991	1,417,982	623,908	708,427
	Outdoor Lighting	7,587,903	7,587,903	5,116,001	5,116,001	175	175	114	114	-	-	-	-
	Plug Loads	105,763	100,806	81,147	76,499	27	26	21	20	-	-	-	-
	Process	541,258,235	368,343,164	369,795,694	183,374,748	66,028	39,212	45,041	19,737	84,056,521	87,897,788	53,401,553	45,954,246
	Refrigeration	12,151,777	8,239,256	8,049,177	4,073,791	1,476	910	1,005	449	(5)	(5)	(3)	(3)
	Water Heating	144,337	94,978	92,375	44,591	28	14	18	7	138,372	117,996	88,575	69,175
	Whole Building	1,626,706	1,473,689	778,380	606,709	1,334	1,217	731	464	2,433,232	3,559,016	1,365,157	1,640,961
	Total	838,166,105	558,780,666	586,560,934	293,507,891	136,743	78,522	98,126	42,969	91,052,419	97,805,203	57,801,939	50,827,182
Residential	Appliance	306,139,626	209,949,451	198,257,143	143,430,996	66,687	48,558	44,233	33,867	6,363,567	6,720,487	5,290,821	5,508,383
	HVAC	44,904,324	44,071,106	32,575,272	31,780,342	56,971	56,672	41,274	41,060	8,966,746	8,958,915	6,413,901	6,406,927
	Indoor Lighting	2,986,735,918	3,432,813,608	1,980,113,407	2,220,859,098	419,695	505,984	278,758	327,641	(34,235,804)	(31,404,932)	(21,789,360)	(20,147,084)
	Other	23,991,879	23,889,545	16,841,470	16,732,846	3,257	3,253	2,318	2,307	2,818,150	2,820,594	1,972,039	1,972,638
	Outdoor Lighting	36,644,160	36,644,160	27,650,531	27,650,531	71	71	47	47	(777)	(777)	(661)	(661)
	Plug Loads	245,807,681	245,807,681	159,735,374	159,735,374	24,741	24,741	16,089	16,089	(2,150,600)	(2,150,600)	(1,366,705)	(1,366,705)
	Process	49,289	36,675	32,872	19,483	5	5	3	3	521,457	527,364	386,909	388,356
	Water Heating	2,344,604	2,344,604	1,594,306	1,594,306	892	892	618	618	18,661,966	18,662,449	13,771,978	13,771,939
	Whole Building	114,156,767	145,043,490	100,301,410	141,905,628	39,159	39,157	29,864	33,211	3,773,941	3,219,399	3,106,689	2,538,092
	Total	3,760,774,247	4,140,600,320	2,517,101,785	2,743,708,604	611,478	679,332	413,205	454,844	4,718,646	7,352,897	7,785,613	9,071,885
Total		9,167,370,414	7,745,154,476	6,415,693,100	4,923,086,294	1,657,287	1,308,177	1,177,027	844,319	154,920,156	172,664,934	101,893,837	93,985,126

Note: Does not include C&S or Low Income data

Appendix C: Emissions Reductions

A key benefit of energy efficiency programs is the reduction in CO2, NOX, and particulate emissions (PM) that would have otherwise occurred. The CPUC uses an emissions rate for electric and gas savings that is dependent on the type of installed technology. The calculations for each technology are embedded in the Commission adopted cost effectiveness calculation1 and, subsequently, the cost effectiveness tools that Energy Division uses to estimate portfolio impacts.

Note that these estimated emissions reductions represent the annual impact of the energy efficient technologies when they are installed and operating -- the lifecycle impacts, if these technologies remain in place for their expected useful life will be significantly higher.

Consistent with Commission policy in place for the 2010–2012 program cycle, the value of the carbon emission reductions is included in the benefits

Electric:

$ER[CO_2]_M$ = Emission rate of CO_2 in tons per kWh of measure ***M***.

Gas:

$ER[CO_2]_{GCT}$ = Emission rate of CO_2 in tons per therm, based on the gas combustion type (GCT) specified on the input sheet for the measure.

Emissions Impacts by IOU

During the 2010-2012 cycle, IOU customers' energy efficiency activities reduced emissions by an estimated 4.3 million tons of CO2, 1.2 million pounds of NOx and more than one-half million pounds of PM–10. Nearly two–thirds of these emissions reductions were the direct result of the program intervention.[2]

side of the calculation of the Total Resource Cost and Program Administrator Cost tests at $30 /ton averaged over time. The avoided air permitting costs embedded in the avoided energy costs are used as a proxy for the benefit resulting from avoiding the other priority pollutant emissions.

1 CPUC Energy Efficiency Policy Manual Version 5, p.50.t

2 Since approximately one-third of program savings are estimated to result from program "free riders" who would have taken the efficiency action without the programs.

Table C-1 Evaluated Emissions Reductions by IOU*†

IOU		Electric			Gas	
		CO_2 (1,000 tons)	NOx (pounds)	PM10 (pounds)	CO_2 (1,000 tons)	NOx (pounds)
PGE	Gross	1,826,929	486,335	235,633	311,367	489,672
	Net	1,120,238	297,938	144,520	159,784	251,284
SCG	Gross				647,508	1,018,303
	Net				362,837	570,615
SDGE	Gross	352,538	94,176	45,428	51,101	80,364
	Net	213,185	56,944	27,472	27,128	42,662
SCE	Gross	2,157,549	577,575	277,869		
	Net	1,421,279	380,446	183,049		
Portfolio	Gross	4,337,017	1,158,086	558,930	1,009,976	1,588,339
	Net	2,754,702	735,329	355,041	549,748	864,561

** Note: Does not include C&S or Low Income data*

† Note: CO_2 is reported in 1,000 tons; NOx and PMs are reported in pounds.

Appendix D: Cost-Effectiveness Results

As cited in the Energy Efficiency Policy Manual, ***"Cost Effectiveness is an indicator of the relative performance or economic attractiveness of any energy efficiency investment or practice when compared to the costs of energy produced and delivered in the absence of such an investment.***[1]***"***

The Commission requires the portfolios to pass a dual cost effectiveness test. The portfolios must provide positive net benefits based on two cost effectiveness tests: the Total Resource Cost test (TRC) and the Program Administrator Cost test (PAC). Since the TRC costs are generally greater than PAC costs, in practice this dual requirement results in the TRC being the primary indicator of energy efficiency program cost effectiveness.

On an evaluated basis, every dollar invested in energy efficiency through the IOUs' 2010-2012 energy efficiency programs resulted in $1.04 in benefits, through the TRC test "lens," and one dollar and $1.66 in benefits based on the PAC test lens. The definition of each of these cost effectiveness tests and how they are used to evaluate the cost effectiveness of the portfolio are discussed in this appendix.

Cost-Effectiveness Tests

The TRC measures the net resource benefits to all ratepayers by combining the net benefits of the program to participants and nonparticipants. The benefits are the avoided costs of the supply-side resources either avoided or deferred. The TRC costs encompass the cost of the measures or equipment installed [by the customer] and the costs incurred by the program administrator for both resource and non-resource program activities.

1 Energy Efficiency Policy Manual, Version 4; p2, http://www.calmac.org/events/EE_Policy_Manual_v4_0.pdf

$$\textbf{TRC} = \frac{\textbf{Benefits} = \text{Net Present Value of avoided costs of supply-side resources avoided}}{\textbf{Costs} = \text{Net Present Value of Measure Costs paid by participants and program administrators} \\ \textbf{+ non-rebate costs incurred by program administrators}}$$

The PAC test measures program benefits in the same way the TRC test does, except that only those costs incurred by the program administrator are included (i.e., measure costs paid by the participating customers are not included).[5]

$$\textbf{PAC} = \frac{\textbf{Benefits} = \text{Net Present Value of avoided costs of supply-side resources avoided}}{\textbf{Costs} = \text{Net Present Value of all costs incurred by program administrators}}$$

Because costs are specific to programs and it is not possible to disaggregate the benefits and costs to specific levels of measures or market sectors in a meaningful way, this report provides portfolio- and program-level cost effectiveness estimates. Appendix A, Table A-1 presents the cost effectiveness of the portfolios as a whole; program level cost effectiveness estimates are provided in Tables 14-17. The costs included in the TRC test remove the measure costs to free-rider participants, since the benefits associated with those participants are excluded as well.

Two additional costs were added to the both the TRC and PAC cost effectiveness calculations after processing utility reported and the evaluation updated values. First, the Energy Savings Performance Incentive (ESPI) has been added. Second, a correction in the rebated costs was made for instances in which the rebates for measures exceeded the measure cost, which results in a "negative cost" in the cost effectiveness calculator (essentially, the payment of a rebate to participants that exceeds the cost of the measure appears as a benefit in the calculator without this post-processing correction). These two cost adjustments are described in further detail below.

Shareholder Incentives for 2010-2012

The Commission adopted a shareholder incentive mechanism that applied for the 2010-2012 period, in D.12-12-032. The shareholder incentive costs are added to the TRC and PAC costs. The source of the costs are derived from the payment claims the utilities have submitted to the Commission. These reflected a 5 percent management fee plus up to an additional 1 percent conformance with ex ante policy. The awards were calculated from the expenditures verified in the Commission's audit.

For 2010-12, all shareholder incentives have been approved by Commission. The awarded amounts are noted in Table D-1.

Table D-1 Shareholder Incentives by IOU

	2010[a]	2011[b]	2012 (requested)[c]
PG&E	$21,037,091	$21,561,992	$23,355,268
SCE	$15,074,939	$13,554,610	$16,194,377
SDG&E	$3,331,920	$3,904,664	$5,094,686
SoCalGas	$2,701,870	$3,075,647	$4,326,851
Total Payments	$42,145,820	$42,096,913	$48,971,182

a D.12-12-032 at page 50.

b Resolution G-3491 (PG&E, SDG&E, and SoCalGas awards), approved December 6, 2013. Resolution E-4633, (SCE awards) approved December 19, 2013.

c Resolution G-3497 (PG&E, SDG&E, SoCalGas awards), approved December 18, 2014. Resolution E-4700 (SCE awards), approved December 18, 2014.

Rebate Costs Exceeding Incremental Measure Costs

Commission policy does not expect, except in rare situations, that rebates[2] paid to participating customers for measure installations will exceed the gross measure installation cost[3] as defined by policy[4]. However, if this situation is proposed by a utility (a proposed rebate that exceeds the measure cost) it is expected to undergo explicit Commission staff review and approval. The claims submitted by the utilities for their 2010-2012 portfolios included a significant number of claim records for which the value of the reported rebate paid to a customer exceeded the gross measure cost . In these cases the cost effectiveness calculation results in a "negative participant net cost". For example, if the rebate to the customer was $100 and the measure cost was only reported as $70 then the participant cost is calculated as -$30.

This relationship, when not reflecting true and appropriate or accurate values, erroneously decreases the total TRC cost of the portfolio, in effect "hiding" real costs that are revenue requirements to operate the programs. The estimated impact of this error for the full 2010-2012 portfolio is $28.6 million. The impact per utility is shown in the following table. The corrected costs have been added to the portfolio and the TRC ratios recalculated.

2 D.08-01-006 at 10: "The definition of the INC term, as set forth in the SPM, is restricted to "dollar benefits" such as rebates or rate incentives (monthly bill credits) paid by the sponsoring utility to the customers participating in the program"

3 D.12-05-015 at 349: "As with all measures, our policy expects that incentives offered for early retirement will not exceed the actual early retirement cost.[495]" footnote: [495] "EEPMv4, Rule IV.4"

4 Policy defines the TRC measure cost as either an incremental, full, or discounted full plus incremental measure installation cost depending upon the measure classification as normal replacement/replace on burnout/new construction, add-on retrofit, or early retirement respectively. See D.12-05-015 at 349.

Table D-2 Excess Rebate Cost Corrections to Claimed Costs*

	Cost Claimed	Sum of Error – Excess Rebates	Corrected Cost
PGE	$1,596,159,470	$19,281,414	$1,681,395,236
SCE	$1,376,850,264	$5,531,325	$1,427,205,515
SCG	$336,223,853	$695,547	$347,023,768
SDGE	$336,148,051	$3,118,504	$351,597,826
Portfolio	$3,645,381,639	$28,626,791	$3,807,222,345

**Costs are TRC Costs, Numbers do not include C&S benefits or costs*

Cost Effectiveness of the 2010-2012 Programs

The impact evaluations conducted by the Commission do not include analysis of program or measure costs or cost effectiveness per se. The cost effectiveness results presented in Table 13 are calculated based on the monetized benefits of the evaluated net energy savings, compared to the incentive and program costs according to existing rules and do not include any external benefits generated by these programs. Indirect savings estimated by studies of the marketing and outreach, education and training programs, and the savings attributable to the utilities' pre–2005 codes and standards advocacy program, are also not included in the cost effectiveness calculations per Commission direction.

The shareholder incentive payments, the corrected "negative costs" resulting from rebates that exceeded measure costs, and the codes and standards advocacy program in 2010-2012 are included in the cost effectiveness calculations provided in Table D-3

Context of the Results

The cost effectiveness rules that guide California energy efficiency planning and evaluation are outlined in more detail in the Standard Practice Manual. These rules are embedded in the cost effectiveness calculators that are used for reporting program accomplishments and planning programs. The rules reflect current Commission policy for assessment of the cost effectiveness of these program activities.

Certain limitations with incremental measure cost data affected the accuracy of the cost effectiveness calculations presented here. These include data quality issues associated with program tracking data as well as deemed estimates for incremental costs that are out of date and may have led to both over- and under-estimates of the incremental measure costs. The largest error has been corrected, as noted above, and corrections at the measure level will be made in the future.

Likewise, the long-term savings benefits may not be accurately reflected by the simple extrapolation of first year energy savings over the expected useful life of the technology. The "dual baseline" effects can both over- and under-estimate long-term savings and consequently distort the real value of the resource. Dual baselines were captured in the 2010-2012 cost effectiveness calculator and were modeled for the non-residential lighting and other program areas where appropriate.

The benefits for these programmatic activities do not consider the potential long-term market effects of the energy efficiency programs. Similarly, short term participant or non-participant spillover effects were not included in the 2010-2012 program period but will be included in the 2013-2014 program cycle savings for the first time. Long term market effects can include program effects on end user decision making (e.g. changes in knowledge and awareness), trade ally practices (e.g., changes in product availability and marketing), and changes in energy efficiency and product and service characteristics (e.g. changes in product costs and features). The primary focus of the 2010–2012 impact evaluations was on the estimation of the immediate and direct impacts of the 2010–2012 programs and the cost benefit calculations reflect those requirements. While the inclusion of market-driven effects could result in higher benefit-cost (B/C) ratios it could also result in a lower level of estimated net savings for utility programs even though total societal savings from both utility program and market forces are significant.

Table D-3 IOU Reported and Commission Evaluated Cost Effectiveness

		Reported			Evaluated					
IOU	**CE Test**	**Benefit (M$)**	**Cost (M$)**	**Ratio**	**Benefit w/C&S (M$)**	**Cost w/C&S (M$)**	**Ratio (w/C&S)**	**Benefit no C&S (M$)**	**Cost no C&S (M$)**	**Ratio-no C&S**
PG&E	TRC	2,310	1,596	1.45	2,238	1,825	1.23	1,595	1,681	0.95
	PAC	2,310	1,024	2.26	2,238	1,123	1.99	1,595	1,109	1.44
SCE	TRC	2,080	1,377	1.51	2,329	1,627	1.43	1,605	1,427	1.12
	PAC	2,080	834	2.49	2,329	889	2.62	1,605	885	1.81
SCG	TRC	407	336	1.21	561	379	1.48	456	347	1.32
	PAC	407	170	2.39	561	182	3.08	456	181	2.52
SDG&E	TRC	425	336	1.27	404	400	1.01	315	352	0.89
	PAC	425	208	2.05	404	225	1.80	315	223	1.41
Portfolio	TRC	5,222	3,645	1.43	5,532	4,230	1.31	3,972	3,807	1.04
	PAC	5,222	2,236	2.34	5,532	2,419	2.29	3,972	2,398	1.66

Table D-4 Cost Effectiveness by Program for PG&E

		Total Resource Cost		Program Administration Cost	
ProgramID	ProgramName	Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
PGE21001	Home Energy Efficiency Surveys Program	0.23	0.55	0.23	0.55
PGE21002	Residential Lighting Incentive Program for Basic CFLs	8.59	9.30	13.01	14.09
PGE21003	Advanced Consumer Lighting Program	1.43	1.50	3.26	3.42
PGE21004	Home Energy Efficiency Rebates	0.53	0.53	1.86	1.86
PGE21005	Appliance Recycling Program	0.75	0.54	0.88	0.63
PGE21006	Business and Consumer Electronics Program	1.72	1.68	2.31	2.26
PGE21007	Multifamily Energy Efficiency Rebates Program	0.91	0.90	1.62	1.61
PGE21008	Whole House Performance Program	0.20	0.05	0.47	0.11
PGE21011	Commercial Calculated Incentives	1.49	0.75	2.71	1.37
PGE21012	Commercial Deemed Incentives	1.68	1.09	3.35	2.17
PGE21013	Commercial Continuous Energy Improvement	-	-	-	-
PGE21014	Nonresidential Commercial Audits Program	0.24	0.24	0.24	0.24
PGE21021	Industrial Calculated Incentives	2.57	1.54	4.77	2.86
PGE21022	Industrial Deemed Incentives	2.01	1.16	2.95	1.70
PGE21023	Industrial Continuous Energy Improvement	-	-	-	-
PGE21024	Nonresidential Industrial Audits Program	0.14	0.14	0.14	0.14
PGE21031	Agricultural Calculated Incentives	2.10	1.10	3.29	1.72
PGE21032	Agricultural Deemed Incentives	1.74	1.46	3.68	3.10
PGE21033	Agricultural Continuous Energy Improvement	-	-	-	-
PGE21034	Nonresidential Agricultural Audits Program	0.13	0.13	0.13	0.13

		Total Resource Cost		Program Administration Cost	
ProgramID	ProgramName	Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
PGE21035	Agricultural Pump Efficiency Services Program	1.54	0.75	3.05	1.49
PGE21041	Residential New Construction	0.48	0.48	0.55	0.55
PGE21042	Savings By Design	2.55	1.20	2.80	1.32
PGE2105	Lighting Market Transformation	-	-	-	-
PGE21061	Upstream HVAC Equipment Incentive	1.11	1.07	1.43	1.38
PGE21062	HVAC Technologies and System Diagnostics Advocacy	-	-	-	-
PGE21063	Commercial Quality Installation	0.00	0.00	0.00	0.00
PGE21064	ENERGY STAR Residential Quality Installation Program	0.24	0.24	0.27	0.27
PGE21065	Residential Quality Maintenance and Commercial Quality Maintenance Development	0.45	0.36	0.53	0.43
PGE21066	Workforce Education & Training	-	-	-	-
PGE21081	Assessments	-	-	-	-
PGE21082	Scaled Field Placement	-	-	-	-
PGE21083	Demonstration / Showcasing	-	-	-	-
PGE21084	Market and Behavioral Studies	-	-	-	-
PGE21085	Technology Supply Side Efforts	-	-	-	-
PGE21086	Incubation	-	-	-	-
PGE21091	WE&T Centergies	-	-	-	-
PGE21092	WE&T Connections	-	-	-	-
PGE21093	WE&T Strategic Plan Implementation	-	-	-	-
PGE21101	Statewide Marketing & Outreach	-	-	-	-
PGE21102	ME&O Strategic Plan Support	-	-	-	-
PGE2111	Statewide DSM Coordination & Integration (3)	-	-	-	-

		Total Resource Cost		Program Administration Cost	
ProgramID	ProgramName	Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
PGE2112	Zero Net Pilots	-	-	-	-
PGE21131	Integrated Marketing	-	-	-	-
PGE21132	Integrated Education & Training	-	-	-	-
PGE21133	Integrated Sales Training	-	-	-	-
PGE21134	Integration Support	-	-	-	-
PGE2114	On-Bill Financing	-	-	-	-
PGE2125	Local Government Energy Action Resource (LGEAR)	0.66	0.30	0.80	0.37
PGE21251	INNOVATOR PILOTS PROGRAM	-	-	-	-
PGE21252	GREEN COMMUNITIES	-	-	-	-
PGE21261	California Community Colleges	0.75	0.40	2.10	1.12
PGE21262	University of California/ California State University	1.40	0.70	2.51	1.24
PGE21263	State of California	1.01	0.54	1.86	0.99
PGE21264	Department of Corrections and Rehabilitation	2.77	1.72	2.74	1.70
PGE2130	Association of Monterey Bay Area Governments (AMBAG) Energy Watch	1.09	0.72	1.31	0.87
PGE2131	City of San Joaquin Energy Watch	1.41	0.52	1.84	0.68
PGE2132	East Bay Energy Watch	2.20	1.19	2.73	1.47
PGE2133	Fresno County Energy Watch	2.21	0.87	3.49	1.38
PGE2134	Kern County Energy Watch	1.17	0.58	1.23	0.62
PGE2135	Madera County Energy Watch	1.86	0.78	3.39	1.42
PGE2136	Marin County Energy Watch	1.13	0.62	1.52	0.83
PGE2137	Mendocino County Energy Watch	0.72	0.30	0.86	0.35
PGE2138	Napa County Energy Watch	1.05	0.64	1.48	0.91
PGE2139	Redwood Energy Watch	1.50	0.90	1.60	0.96
PGE2140	San Joaquin County Energy Watch	1.51	0.76	1.59	0.80
PGE2141	San Luis Obispo County Energy Watch	1.01	0.51	1.05	0.53

		Total Resource Cost		Program Administration Cost	
ProgramID	ProgramName	Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
PGE2142	San Mateo County Energy Watch	1.01	0.48	1.35	0.65
PGE2143	Santa Barbara County Energy Watch	1.03	0.55	1.09	0.58
PGE2144	Sierra Nevada Energy Watch	1.22	0.61	1.59	0.79
PGE2145	Sonoma County Energy Watch	0.76	0.44	1.52	0.88
PGE2146	Silicon Valley Energy Watch	1.19	0.58	1.51	0.74
PGE2147	San Francisco Energy Watch	1.76	1.24	1.86	1.31
PGE2176	California New Homes Multifamily	0.90	0.90	0.88	0.88
PGE2177	Enhance Time Delay Relay	0.74	0.74	0.79	0.79
PGE2178	ENERGY STAR Manufactured Homes	0.66	0.66	0.78	0.78
PGE2179	Direct Install for Manufactured and Mobile Homes	1.98	1.98	1.98	1.98
PGE2181	Air Care Plus	1.92	1.41	2.12	1.56
PGE2182	Boiler Energy Efficiency Program	1.01	0.75	1.70	1.26
PGE2183	Comprehensive Retail Energy Management	1.16	0.47	1.39	0.57
PGE2185	EnergySmart Grocer	1.65	1.61	2.64	2.58
PGE2186	Enhanced Automation Initiative	5.18	2.76	6.13	3.26
PGE2187	Monitoring-Based Persistence Commissioning	1.06	0.50	1.68	0.78
PGE2189	Cool Controls Plus	1.99	1.96	1.99	1.96
PGE2190	LodgingSavers	1.55	1.07	1.56	1.07
PGE2191	Medical Building Tune-Up	1.14	0.49	1.20	0.52
PGE2193	School Energy Efficiency	0.93	0.74	1.32	1.05
PGE2194	Energy Fitness Program	2.44	0.93	4.08	1.56
PGE2195	Energy Savers	1.66	1.09	1.96	1.28
PGE2196	RightLights	2.27	1.01	2.27	1.01
PGE2197	Small Business Commercial Comprehensive	2.03	1.37	2.03	1.37
PGE2198	DCCCP Quest	1.42	0.69	1.71	0.84

		Total Resource Cost		Program Administration Cost	
ProgramID	ProgramName	Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
PGE2199	Energy-Efficient Parking Garage	1.37	1.35	1.58	1.56
PGE2200	Furniture Store Energy Efficiency	1.07	0.46	1.07	0.46
PGE2201	High Performance Office Lighting	1.63	1.61	1.49	1.48
PGE2202	LED Accelerator	1.23	1.20	1.06	1.03
PGE2203	Monitoring-Based Commissioning	-	-	-	-
PGE2204	SmartVent for Energy-Efficient Kitchens	1.23	1.23	1.23	1.23
PGE2205	Casino Green	1.89	1.08	1.91	1.09
PGE2206	Healthcare Energy Efficiency Program	0.39	0.20	0.44	0.23
PGE2209	Ozone Laundry Energy Efficiency	1.26	0.75	1.46	0.87
PGE2210	Cool Schools	-	-	-	-
PGE2212	California Preschool Energy Efficiency Program	1.31	0.54	1.31	0.54
PGE2213	K-12 Private Schools and Colleges Audit Retro	0.65	0.32	0.81	0.40
PGE2214	EE Entertainment Centers	0.98	0.96	1.02	1.00
PGE2220	AIM Compressed Air Efficiency	1.05	0.47	1.13	0.51
PGE2221	California Wastewater Process Optimization	0.95	0.47	1.36	0.67
PGE2222	Energy Efficiency Services for Oil Production	1.50	0.74	3.86	1.90
PGE2223	Heavy Industry Energy Efficiency Program	1.80	1.02	2.24	1.27
PGE2224	Industrial Compressed Air	2.16	0.97	2.32	1.04
PGE2225	Refinery Energy Efficiency Program	2.07	1.31	5.15	3.25
PGE2227	Cement Production and Distribution Energy Efficiency	0.06	0.03	0.07	0.03
PGE2228	Industrial Recommissioning Program	1.30	0.68	1.35	0.71
PGE2230	Dairy Energy Efficiency Program	0.76	0.71	1.83	1.70
PGE2231	Industrial Refrigeration Performance Plus	0.76	0.39	2.31	1.18
PGE2232	Light Exchange Program	1.18	1.16	1.18	1.16

ProgramID	ProgramName	Total Resource Cost		Program Administration Cost	
		Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
PGE2233	Wine Industry Efficiency Solutions	0.79	0.57	1.23	0.90
PGE2234	Comprehensive Food Process Audit & Resource Efficiency Pgm	1.52	0.79	2.08	1.09
PGE2235	Dairy Industry Resource Advantage Pgm	1.42	0.75	1.69	0.89
PGE2236	Process Wastewater Treatment EM Pgm for Ag Food Processing	2.85	1.28	3.25	1.46
PGE2240	Builder Energy Code Training	-	-	-	-
PGE2241	Green Building Technical Support Services	-	-	-	-
PGE2242	Cool Cash	0.33	0.13	0.38	0.15

Table D-5 Cost Effectiveness by Program for SCE

ProgramID	ProgramName	Total Resource Cost		Program Administration Cost	
		Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SCE-L-001	On-Line Buyer's Guide	-	-	-	-
SCE-L-002	Financial Solutions	-	-	-	-
SCE-L-003	Integrated Demand Side Management Pilot for Food Processing	-	-	-	-
SCE-L-004A	City of Beaumont Energy Leader Partnership	0.26	0.15	0.27	0.16
SCE-L-004B	City of Long Beach Energy Leader Partnership	1.15	0.82	1.56	1.11
SCE-L-004C	City of Redlands Energy Leader Partnership	0.57	0.31	0.84	0.46
SCE-L-004D	City of Ridgecrest Energy Leader Partnership	0.01	0.01	0.01	0.01
SCE-L-004E	City of Santa Ana Energy Leader Partnership	0.43	0.32	1.01	0.77
SCE-L-004F	City of Simi Valley Energy Leader Partnership	0.52	0.32	0.60	0.37

ProgramID	ProgramName	Total Resource Cost		Program Administration Cost	
		Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SCE-L-004G	City of South Gate Energy Leader Partnership	0.11	0.09	0.28	0.23
SCE-L-004H	Community Energy Leader Partnership	0.76	0.53	1.39	0.97
SCE-L-004I	Desert Cities Energy Leader Partnership	0.72	0.60	1.25	1.05
SCE-L-004J	Eastern Sierra Energy Leader Partnership	0.06	0.05	0.06	0.05
SCE-L-004K	Energy Leader Partnership Strategic Support	-	-	-	-
SCE-L-004L	Kern County Energy Leader Partnership	0.38	0.24	0.40	0.25
SCE-L-004M	Orange County Cities Energy Leader Partnership	0.57	0.33	1.81	1.04
SCE-L-004N	Palm Desert Demonstration Partnership	0.62	0.49	0.78	0.61
SCE-L-004O	San Gabriel Valley Energy Leader Partnership	1.04	0.79	2.05	1.56
SCE-L-004P	San Joaquin Valley Energy Leader Partnership	0.97	0.56	1.75	1.01
SCE-L-004Q	South Bay Energy Leader Partnership	0.59	0.39	1.08	0.71
SCE-L-004R	South Santa Barbara County Energy Leader Partnership	0.26	0.19	0.45	0.33
SCE-L-004Rollup	Energy Leader Partnership Program	-	-	-	-
SCE-L-004S	Ventura County Energy Leader Partnership	0.54	0.31	0.82	0.48
SCE-L-004T	Local Government Strategic Planning Pilot Program	-	-	-	-
SCE-L-004U	Western Riverside Energy Leader Partnership	0.65	0.44	0.84	0.57
SCE-L-004V	City of Adelanto Energy Leader Partnership	0.17	0.10	0.48	0.30

ProgramID	ProgramName	Total Resource Cost		Program Administration Cost	
		Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SCE-L-004W	West Side Energy Leader Partnership	1.18	1.06	2.72	2.43
SCE-L-005A	California Community Colleges Energy Efficiency Partnership	0.67	0.44	1.74	1.14
SCE-L-005B	California Department of Corrections and Rehabilitation Energy Efficiency Partnership	0.60	0.37	1.35	0.83
SCE-L-005C	County of Los Angeles Energy Efficiency Partnership	0.67	0.33	1.94	0.97
SCE-L-005D	County of Riverside Energy Efficiency Partnership	0.69	0.41	0.77	0.45
SCE-L-005E	County of San Bernardino Energy Efficiency Partnership	0.73	0.53	1.27	0.91
SCE-L-005F	State of California Energy Efficiency Partnership	1.06	0.65	2.10	1.28
SCE-L-005G	UC/CSU Energy Efficiency Partnership	0.99	0.59	2.33	1.39
SCE-L-005Rollup	IGREEN	-	-	-	-
SCE-L-006	Integrated Marketing & Outreach	-	-	-	-
SCE-SW-001A	Home Energy Efficiency Survey Program	0.88	1.00	1.61	1.85
SCE-SW-001B	Residential Lighting Incentive Program for Basic CFLs	6.48	8.12	9.15	11.46
SCE-SW-001C	Advanced Consumer Lighting Program	3.08	3.06	5.74	5.70
SCE-SW-001D	Home Energy Efficiency Rebate Program	1.14	1.14	1.26	1.26
SCE-SW-001E	Appliance Recycling Program	1.53	1.03	1.53	1.03
SCE-SW-001F	Business and Consumer Electronics Program	2.90	2.85	4.00	3.94
SCE-SW-001G	Multifamily Energy Efficiency Rebate Program	1.30	1.30	1.15	1.15

		Total Resource Cost		Program Administration Cost	
ProgramID	ProgramName	Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SCE-SW-001H	Whole House Prescriptive Program	0.03	0.04	0.03	0.04
SCE-SW-002A	Non-Residential Audits	-	-	-	-
SCE-SW-002B	Calculated Incentives Program	1.05	0.62	3.27	1.92
SCE-SW-002C	Deemed Incentives Program	1.37	0.84	3.90	2.39
SCE-SW-002D	Commercial Direct Install Program	1.94	0.90	1.94	0.90
SCE-SW-002E	Continuous Energy Improvement	-	-	-	-
SCE-SW-003A	Industrial Energy Audit Program	-	-	-	-
SCE-SW-003B	Industrial Calculated Energy Efficiency Program	1.50	0.79	3.98	2.09
SCE-SW-003C	Industrial Deemed Energy Efficiency Program	1.44	0.74	3.57	1.82
SCE-SW-003D	Industrial Continuous Energy Improvement Program	-	-	-	-
SCE-SW-004A	Agriculture Energy Audit Program	-	-	-	-
SCE-SW-004B	Agriculture Calculated Energy Efficiency Program	1.22	0.67	2.66	1.46
SCE-SW-004C	Agriculture Deemed Energy Efficiency Program	1.01	0.59	1.86	1.09
SCE-SW-004D	Agriculture Continuous Energy Improvement Program	-	-	-	-
SCE-SW-004E	Pump Test Services Program	0.82	0.82	2.08	2.08
SCE-SW-005A	Savings By Design	2.41	1.44	3.59	2.14
SCE-SW-005B	California Advanced Homes	0.40	0.40	0.39	0.39
SCE-SW-005C	Energy Star Manufactured Housing	-	-	-	-

		Total Resource Cost		Program Administration Cost	
ProgramID	ProgramName	Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SCE-SW-006	Statewide Lighting Market Transformation Program	-	-	-	-
SCE-SW-007A	Upstream HVAC Equipment Incentive	0.99	1.11	2.09	2.35
SCE-SW-007B	HVAC Technologies and System Diagnostics Advocacy	-	-	-	-
SCE-SW-007C	Commercial Quality Installation	-	-	-	-
SCE-SW-007D	ENERGY STAR Residential Quality Installation Program	0.02	0.01	0.07	0.03
SCE-SW-007E	Residential Quality Maintenance and Commercial Quality Maintenance Development	0.23	0.17	0.22	0.17
SCE-SW-007F	HVAC Workforce Education & Training	-	-	-	-
SCE-SW-008	CFL Adjustment	-	-	-	-
SCE-SW-009A	Technology Assessments	-	-	-	-
SCE-SW-009B	Scaled Field Placements	-	-	-	-
SCE-SW-009C	Demonstration Showcases	-	-	-	-
SCE-SW-009D	Market and Behavioral Studies	-	-	-	-
SCE-SW-009E	Technology Development Support	-	-	-	-
SCE-SW-009F	Business Incubation Support	-	-	-	-
SCE-SW-009G	Technology Test Centers	-	-	-	-
SCE-SW-009Rollup	Program Mgmt & CPUC Reporting	-	-	-	-
SCE-SW-010A	WE&T Centergies	-	-	-	-
SCE-SW-010B	WE&T Connections	0.42	0.42	0.42	0.42
SCE-SW-010C	WE&T Planning	-	-	-	-
SCE-SW-011A	Statewide ME&O	-	-	-	-
SCE-SW-011B	ME&O Strategic Plan	-	-	-	-
SCE-SW-012	Integrated DSM	-	-	-	-
SCE-SW-CFL	CFL Adjustment	-	-	-	-

		Total Resource Cost		Program Administration Cost	
ProgramID	ProgramName	Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SCE-TP-001	Efficient Affordable Housing	-	-	-	-
SCE-TP-002	Comprehensive Mobile Home	1.13	1.13	1.13	1.13
SCE-TP-003	Comprehensive Home Performance	0.05	0.03	0.06	0.04
SCE-TP-004	Community Language Efficiency Outreach	-	-	-	-
SCE-TP-005	Cool Planet	-	-	-	-
SCE-TP-006	Healthcare EE Program (HEEP)	0.77	0.41	1.93	1.02
SCE-TP-007	Livestock Industry Resource Advantage	-	-	-	-
SCE-TP-008	Comprehensive Beverage Manufacturing and Resource Efficiency	0.48	0.24	1.84	0.90
SCE-TP-009	Solid Waste Energy Efficiency Program	-	-	-	-
SCE-TP-010	Data Center Energy Efficiency	0.73	0.45	1.09	0.68
SCE-TP-011	Data Center Optimization	-	-	-	-
SCE-TP-012	Lodging EE Program (LEEP)	1.00	0.56	2.15	1.22
SCE-TP-013	Food & Kindred Products	1.63	0.80	2.43	1.19
SCE-TP-014	Primary and Fabricated Metals	1.99	0.89	3.12	1.39
SCE-TP-015	Industrial Gasses	1.15	0.64	1.39	0.77
SCE-TP-016	Nonmetallic Minerals and Products	1.30	0.68	2.41	1.26
SCE-TP-017	Comprehensive Chemical Products	0.45	0.25	0.52	0.28
SCE-TP-018	Chemical Products Efficiency Program (CPEP)	0.69	0.34	0.82	0.40
SCE-TP-019	Comprehensive Petroleum Refining	0.23	0.12	0.24	0.13
SCE-TP-020	Oil Production	1.95	1.04	3.08	1.64
SCE-TP-021	Refinery Energy Efficiency Program (REEP)	3.20	1.36	3.55	1.51
SCE-TP-023	Cool Schools	0.29	0.23	0.42	0.32

ProgramID	ProgramName	Total Resource Cost		Program Administration Cost	
		Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SCE-TP-024	Public Pre-Schools, Elementary Schools and High Schools	1.93	0.82	1.93	0.82
SCE-TP-025	Retail Energy Action Program (REAP)	0.74	0.60	1.58	1.30
SCE-TP-026	Commercial Utility Building Efficiency (CUBE)	0.79	0.43	1.43	0.78
SCE-TP-027	Monitoring-Based Commissioning (MBx)	-	-	-	-
SCE-TP-028	Monitoring-Based Persistence Commissioning Program (MBPCx)	-	-	-	-
SCE-TP-030	Sustainable Portfolios	-	-	-	-
SCE-TP-031	Management Affiliates Program (MAP)	1.01	0.61	1.60	0.96
SCE-TP-032	Private College Campus Housing	-	-	-	-
SCE-TP-033	Automatic Energy Review for Schools	4.55	2.45	5.71	3.07
SCE-TP-034	Sustainable Communities	-	-	-	-
SCE-TP-036	Energy Efficiency for Entertainment Centers	1.84	1.66	1.84	1.66
SCE-TP-037	Private Schools and Colleges Program	1.65	0.69	1.65	0.69
SCE-TP-038	California Preschools Program (CPEEP)	1.13	0.46	1.13	0.46
SCE-TP-0608	Coin Operated Laundry Program	0.86	0.38	0.89	0.39

Table D-6 Cost Effectiveness by Program for SCG

ProgramID	ProgramName	Total Resource Cost		Program Administration Cost	
		Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SCG3600	Local02 - Local Whole Home Performance	0.27	0.14	0.43	0.22
SCG3601	Local05 - Local Non-Residential BID	2.02	2.44	6.37	7.71

		Total Resource Cost		Program Administration Cost	
ProgramID	ProgramName	Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SCG3602	SW-AgA - Calculated	1.69	2.04	3.48	4.22
SCG3603	SW-AgB - Deemed	0.92	0.92	1.07	1.07
SCG3604	SW-AgC - Nonresidential Audits	-	-	-	-
SCG3605	SW-AgD - Pump Test & Repair	-	-	-	-
SCG3606	SW-AgE - Continuous Energy Improvement	-	-	-	-
SCG3607	SW-ComA - Calculated	0.93	1.11	4.39	5.26
SCG3608	SW-ComB - Deemed	0.87	0.87	1.01	1.01
SCG3609	SW-ComC - Nonresidential Audits	-	-	-	-
SCG3610	SW-ComD - Continuous Energy Improvement	-	-	-	-
SCG3611	SW-IndA - Calculated	2.39	2.90	7.08	8.57
SCG3612	SW-IndB - Deemed	5.23	5.98	7.40	8.46
SCG3613	SW-IndC - Nonresidential Audits	-	-	-	-
SCG3614	SW-IndD - Continuous Energy Improvement	-	-	-	-
SCG3615	SW-ResA - Multifamily EE Rebates	1.08	1.08	1.73	1.73
SCG3616	SW-ResB - Home Efficiency Rebates	0.84	0.84	2.67	2.67
SCG3617	SW-ResC - Home Efficiency Energy Survey	-	-	-	-
SCG3618	SW-ResD - Prescriptive Whole House Retrofit	0.01	0.01	0.01	0.01
SCG3619	L-InstP01 - CA Depart of Corrections Partnership	-	-	-	-
SCG3620	L-InstP02 - CA Community College Partnership	-	-	-	-
SCG3621	L-InstP03 - UC/CSU/IOU Partnership	-	-	-	-
SCG3622	L-InstP04 - State of California /IOU Partnership	-	-	-	-
SCG3623	SW-ME&OB - SW Marketing, E&O FYP	-	-	-	-
SCG3624	SW-ETA - Assessments	-	-	-	-

		Total Resource Cost		Program Administration Cost	
ProgramID	ProgramName	Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SCG3625	SW-NCNR - NRNC Savings By Design	1.27	1.06	2.39	1.99
SCG3626	SW-NCResA - RNC	0.40	0.40	0.59	0.59
SCG3627	SW-WE&TA - Strategic Planning & Implementation	-	-	-	-
SCG3628	SW-WE&TB - WE&T Centers	-	-	-	-
SCG3629	SW-WE&TC - WE&T Connections	-	-	-	-
SCG3630	LGovP01 - LA County IOU Partnership	-	-	-	-
SCG3631	LGovP02 - Kern County Energy Watch Partnership	-	-	-	-
SCG3632	LGovP03 - Riverside County Partnership	-	-	-	-
SCG3633	LGovP04 - San Bernardino County IOU Partnership	-	-	-	-
SCG3634	LGovP05 - Santa Barbara County IOU Partnership	-	-	-	-
SCG3635	LGovP06 - SBCCOG Partnership	-	-	-	-
SCG3636	LGovP07 - San Luis Obispo County Partnership	-	-	-	-
SCG3637	LGovP08 - Tulare Cnty-Visalia Energy Watch Prtnr	-	-	-	-
SCG3638	LGovP09 - Orange County Cities Partnership	-	-	-	-
SCG3639	LGovP10 - ILG IOU Partnership	-	-	-	-
SCG3640	LGovP11 - Community Energy Partnership	-	-	-	-
SCG3641	LGovP12 - Desert Cities Partnership	-	-	-	-
SCG3642	LGovP13 - VCREA Sub-Program Partnership	-	-	-	-
SCG3643	LGovP14 - Palm Desert IOU Pilot Partnership	-	-	-	-
SCG3644	Local01 - OBF	-	-	-	-
SCG3645	Local03 - Local Sustainable Communities (RMV)	-	-	-	-

		Total Resource Cost		Program Administration Cost	
ProgramID	ProgramName	Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SCG3646	Local04 - Local Strategic Develop & Integ	-	-	-	-
SCG3651	SW-HVACA - Residential Energy Star Quality Insta	-	-	-	-
SCG3652	SW-HVACB - Commercial Quality Installation	-	-	-	-
SCG3653	SW-HVACC - Commercial Upstream Equipment	-	-	-	-
SCG3654	SW-HVACD - Quality Maintenance Program	-	-	-	-
SCG3655	SW-HVACE - Technology & Systems Diagnostics	-	-	-	-
SCG3656	SW-HVACF - HVAC WE&T	-	-	-	-
SCG3657	SW-HVACG - HVAC Core	-	-	-	-
SCG3658	SW-IDSM - SW Integrated DSM	-	-	-	-
SCG3659	SW-ME&O C - ME&O Strategic Plan	-	-	-	-
SCG3660	3P-NRes1 - Steam Trap and Compressed Air Survey	-	-	-	-
SCG3661	3P-NRes2 - Energy Challenger	-	-	-	-
SCG3662	3P-NRes3 - Small Industrial Facility Upgrades	0.44	0.47	0.83	0.87
SCG3663	3P-NRes4 - Program for Resource Efficiency in Private Schools	1.07	1.10	1.27	1.31
SCG3664	3P-Res01 - On Demand Efficiency	1.65	1.65	2.08	2.08
SCG3665	3P-Res02 - HERS Rater Training Advancement	-	-	-	-
SCG3666	3P-Res03 - Multifamily Home Tune-Up	1.26	1.26	1.53	1.53
SCG3667	3P-Res04 - Multifamily Solar Pool Heating	0.14	0.14	0.15	0.15
SCG3668	3P-Res05 - Community Language Effic Outreach	-	-	-	-
SCG3669	3P-Res06 - Multifamily Direct Therm Savings	1.59	1.59	1.70	1.70
SCG3670	3P-Res07 - LivingWise	3.53	3.53	4.27	4.27

ProgramID	ProgramName	Total Resource Cost		Program Administration Cost	
		Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SCG3671	3P-Res09 - Manufactured Mobile Home	2.16	2.16	2.23	2.23
SCG3672	3P-Xc01 - Gas Cooling Retrofit	0.17	0.17	0.18	0.18
SCG3673	3P-Xc02 - SaveGas Hot Water Control	2.36	2.36	2.36	2.36
SCG3674	3P-Xc03 - Upstream High Efficiency Gas Water Heater	0.60	0.60	2.56	2.56
SCG3675	3P-Xc04 - California Sustainability Alliance	-	-	-	-
SCG3676	3P-Xc05 - Portfolio of the Future (PoF)	-	-	-	-
SCG3677	3P-Xc06 - PACE Energy Savings Project	-	-	-	-
SCG3678	EM&V - Evaluation Measurement & Verification	-	-	-	-

Table D-7 Cost Effectiveness by Program for SDG&E

ProgramID	ProgramName	Total Resource Cost		Program Administration Cost	
		Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SDGE3100	SW-AgA - Calculated	0.39	0.20	0.54	0.29
SDGE3101	SW-AgB - Deemed	1.05	0.89	1.23	1.05
SDGE3102	SW-AgC - Nonresidential Audits	-	-	-	-
SDGE3103	SW-AgD - Pump Test & Repair	-	-	-	-
SDGE3104	SW-AgE - Continuous Energy Improvement	-	-	-	-
SDGE3105	SW-ComA - Calculated	1.32	0.97	4.83	3.54
SDGE3106	SW-ComB - Deemed	1.60	1.15	4.34	3.11
SDGE3107	SW-ComC - Nonresidential Audits	-	-	-	-
SDGE3108	SW-ComD - Continuous Energy Improvement	-	-	-	-
SDGE3109	SW-IndA - Calculated	1.12	0.72	2.93	1.89
SDGE3110	SW-IndB - Deemed	2.03	1.24	3.20	1.96
SDGE3111	SW-IndC - Nonresidential Audits	-	-	-	-

ProgramID	ProgramName	Total Resource Cost		Program Administration Cost	
		Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SDGE3112	SW-IndD - Continuous Energy Improvement	-	-	-	-
SDGE3113	SW-ResA - Residential Basic Lighting	4.39	4.37	5.09	5.07
SDGE3114	SW-ResB - Advanced Consumer Lighting	2.24	2.04	3.93	3.59
SDGE3115	SW-ResG - Business/ Consumer Electronics/Plug Load	0.70	0.68	1.58	1.55
SDGE3116	Local01 - Local Whole House Perfomance	0.74	0.33	0.78	0.35
SDGE3117	Local03 - Local Non-Residential (BID)	1.71	1.16	4.19	2.84
SDGE3118	SW-NCNR - NRNC Savings By Design	2.02	1.13	3.15	1.77
SDGE3119	SW-ResC - Multi-Family	0.93	0.93	1.31	1.31
SDGE3120	SW-NCResB - E-Star Manufactured Homes	0.02	0.02	0.02	0.02
SDGE3121	SW-ResD - Home Efficiency Rebates	0.72	0.72	1.90	1.89
SDGE3122	SW-ResE - Home Efficiency Surveys	-	-	-	-
SDGE3123	L-InstP01 - CA Depart of Corrections Partnership	-	-	-	-
SDGE3124	L-InstP02 - CA Community College Partnership	-	-	-	-
SDGE3125	L-InstP03 - UC/CSU/IOU Partnership	-	-	-	-
SDGE3126	L-InstP04 - State of California /IOU Partnership	-	-	-	-
SDGE3127	L-InstP05 - University of San Diego Partnership	-	-	-	-
SDGE3128	L-InstP06 - San Diego Cnty Water Auth Partnership	-	-	-	-
SDGE3129	LGovP01 - City of Chula Vista Partnership	-	-	-	-
SDGE3130	LGovP02 - City of San Diego Partnership	-	-	-	-
SDGE3131	LGovP03 - County of San Diego Partnership	-	-	-	-

ProgramID	ProgramName	Total Resource Cost		Program Administration Cost	
		Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SDGE3132	LGovP04 - City of San Juan Capistrano Partnership	-	-	-	-
SDGE3133	LGovP05 - Port of San Diego Partnership	-	-	-	-
SDGE3134	LGovP06 - SANDAG Partnership	-	-	-	-
SDGE3135	LGovP07 - ICLEI Partnership	-	-	-	-
SDGE3136	LGovP08 - New Cities Partnership	-	-	-	-
SDGE3137	Local02 - Local Island Program	0.42	0.42	0.42	0.42
SDGE3138	Local04 - Local Sustainable Communities (RMV)	-	-	-	-
SDGE3139	Local05 - OBF	-	-	-	-
SDGE3140	Local06 - Local Strategic Development & Integrat	-	-	-	-
SDGE3145	SW-HVACA - Residential Energy Star Quality Instal	-	-	-	-
SDGE3146	SW-HVACB - Commercial Quality Installation	-	-	-	-
SDGE3147	SW-HVACC - Commercial Upstream Equipment	-	-	-	-
SDGE3148	SW-HVACD - Quality Maintenance Program	-	-	-	-
SDGE3149	SW-HVACE - Technology & Systems Diagnostics	-	-	-	-
SDGE3150	SW-HVACF - HVAC WE&T	-	-	-	-
SDGE3151	SW-HVACG - HVAC Core	-	-	-	-
SDGE3152	SW-IDSM - SW Integrated DSM	-	-	-	-
SDGE3153	SW Marketing, E&O FYP	-	-	-	-
SDGE3154	SW-ME&O C - Strategic Plan	-	-	-	-
SDGE3155	SW-ETA - Assessments	-	-	-	-
SDGE3156	SW-ResH - Prescriptive Whole House Retrofit	0.26	0.16	0.26	0.16
SDGE3157	SW-WE&TA - Strategic Planning & Implementation	-	-	-	-

		Total Resource Cost		Program Administration Cost	
ProgramID	ProgramName	Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SDGE3158	SW-WE&TB - WE&T Centers – SDERC, Food Service Cen	-	-	-	-
SDGE3159	SW-WE&TC - WE&T Connections – PEAK Program	-	-	-	-
SDGE3160	SW-NCResA - RNC	0.40	0.40	0.51	0.51
SDGE3161	3P-NRes01 - Non-Res HVAC Tune-up/Quality Installa	1.13	0.98	1.62	1.42
SDGE3162	3P-NRes02 - SaveGas Hot Water Control	2.05	2.05	2.27	2.27
SDGE3163	3P-NRes03 - Business Energy Assessment (BEA)	-	-	-	-
SDGE3164	3P-NRes06 - Energy Efficient Water Pumping	-	-	-	-
SDGE3165	3P-NRes07 - Healthcare Energy Efficiency Program	-	-	-	-
SDGE3166	3P-NRes08 - Lodging Energy Efficiency Program	-	-	-	-
SDGE3167	3P-NRes09 - Mobile Energy Clinic (MEC)	0.81	0.71	0.83	0.72
SDGE3168	3P-NRes11 - Portfolio of the Future (PoF)	-	-	-	-
SDGE3169	3P-NRes12 - Comprehensive Industrial Energy Effic	-	-	-	-
SDGE3170	3P-NRes13 - Retro Commissioning (RCx)	2.91	1.27	3.56	1.55
SDGE3171	3P-Res01 - Res HVAC Tune-up/Quality Installation	0.45	0.45	0.54	0.54
SDGE3172	3P-Res02 - Comprehensive Mobile Home (SW)	0.88	0.88	1.24	1.24
SDGE3173	3P-Res04 - K-12 Energy Efficiency Education (E3)	-	-	-	-
SDGE3174	SW-ComE - Direct Install	1.36	0.74	1.37	0.75
SDGE3175	SW-ResF - Appliance Recycling	1.08	0.58	1.46	0.79
SDGE3176	Kitchen Learning Center	-	-	-	-
SDGE3177	EM&V-Evaluation Measurement & Verification	-	-	-	-

ProgramID	ProgramName	Total Resource Cost		Program Administration Cost	
		Reported TRC	Evaluated TRC	Reported PAC	Evaluated PAC
SDGE3178	LGovP10 - County of San Diego - ARRA Continued Programs	-	-	-	-
SDGE3179	LGovP09 - City of San Diego - ARRA Continued Programs	-	-	-	-

Appendix E: Program Level Summary of Outputs

This appendix provides a summary of the energy savings, cost effectiveness and emissions impacts for every program that was evaluated in 2010-2012 for each of the four IOUs.

Table E-1 PG&E Savings, Cost Effectiveness and Emissions Reductions by Program

		Total Resource Cost		Program Administration Cost	
ProgramID	**Program Name**	**Reported**	**Evaluated**	**Reported**	**Evaluated**
PGE21001	Home Energy Efficiency Surveys Program	0.23	0.55	0.23	0.55
PGE21002	Residential Lighting Incentive Program for Basic CFLs	8.59	9.3	13.01	14.09
PGE21003	Advanced Consumer Lighting Program	1.43	1.5	3.26	3.42
PGE21004	Home Energy Efficiency Rebates	0.53	0.53	1.86	1.86
PGE21005	Appliance Recycling Program	0.75	0.54	0.88	0.63
PGE21006	Business and Consumer Electronics Program	1.72	1.68	2.31	2.26
PGE21007	Multifamily Energy Efficiency Rebates Program	0.91	0.9	1.62	1.61
PGE21008	Whole House Performance Program	0.2	0.05	0.47	0.11
PGE21011	Commercial Calculated Incentives	1.49	0.75	2.71	1.37
PGE21012	Commercial Deemed Incentives	1.68	1.09	3.35	2.17
PGE21013	Commercial Continuous Energy Improvement	-	-	-	-
PGE21014	Nonresidential Commercial Audits Program	0.24	0.24	0.24	0.24
PGE21021	Industrial Calculated Incentives	2.57	1.54	4.77	2.86
PGE21022	Industrial Deemed Incentives	2.01	1.16	2.95	1.7
PGE21023	Industrial Continuous Energy Improvement	-	-	-	-
PGE21024	Nonresidential Industrial Audits Program	0.14	0.14	0.14	0.14
PGE21031	Agricultural Calculated Incentives	2.1	1.1	3.29	1.72
PGE21032	Agricultural Deemed Incentives	1.74	1.46	3.68	3.1
PGE21033	Agricultural Continuous Energy Improvement	-	-	-	-
PGE21034	Nonresidential Agricultural Audits Program	0.13	0.13	0.13	0.13
PGE21035	Agricultural Pump Efficiency Services Program	1.54	0.75	3.05	1.49

		Total Resource Cost		Program Administration Cost	
ProgramID	**Program Name**	**Reported**	**Evaluated**	**Reported**	**Evaluated**
PGE21041	Residential New Construction	0.48	0.48	0.55	0.55
PGE21042	Savings By Design	2.55	1.2	2.8	1.32
PGE2105	Lighting Market Transformation	-	-	-	-
PGE21061	Upstream HVAC Equipment Incentive	1.11	1.07	1.43	1.38
PGE21062	HVAC Technologies and System Diagnostics Advocacy	-	-	-	-
PGE21063	Commercial Quality Installation	0	0	0	0
PGE21064	ENERGY STAR Residential Quality Installation Program	0.24	0.24	0.27	0.27
PGE21065	Residential Quality Maintenance and Commercial Quality Maintenance Development	0.45	0.36	0.53	0.43
PGE21066	Workforce Education & Training	-	-	-	-
PGE21081	Assessments	-	-	-	-
PGE21082	Scaled Field Placement	-	-	-	-
PGE21083	Demonstration / Showcasing	-	-	-	-
PGE21084	Market and Behavioral Studies	-	-	-	-
PGE21085	Technology Supply Side Efforts	-	-	-	-
PGE21086	Incubation	-	-	-	-
PGE21091	WE&T Centergies	-	-	-	-
PGE21092	WE&T Connections	-	-	-	-
PGE21093	WE&T Strategic Plan Implementation	-	-	-	-
PGE21101	Statewide Marketing & Outreach	-	-	-	-
PGE21102	ME&O Strategic Plan Support	-	-	-	-
PGE2111	Statewide DSM Coordination & Integration (3)	-	-	-	-
PGE2112	Zero Net Pilots	-	-	-	-
PGE21131	Integrated Marketing	-	-	-	-
PGE21132	Integrated Education & Training	-	-	-	-
PGE21133	Integrated Sales Training	-	-	-	-
PGE21134	Integration Support	-	-	-	-
PGE2114	On-Bill Financing	-	-	-	-
PGE2125	Local Government Energy Action Resource (LGEAR)	0.66	0.3	0.8	0.37
PGE21251	INNOVATOR PILOTS PROGRAM	-	-	-	-
PGE21252	GREEN COMMUNITIES	-	-	-	-
PGE21261	California Community Colleges	0.75	0.4	2.1	1.12
PGE21262	University of California/California State University	1.4	0.7	2.51	1.24

		Total Resource Cost		Program Administration Cost	
ProgramID	Program Name	Reported	Evaluated	Reported	Evaluated
PGE21263	State of California	1.01	0.54	1.86	0.99
PGE21264	Department of Corrections and Rehabilitation	2.77	1.72	2.74	1.7
PGE2130	Association of Monterey Bay Area Governments (AMBAG) Energy Watch	1.09	0.72	1.31	0.87
PGE2131	City of San Joaquin Energy Watch	1.41	0.52	1.84	0.68
PGE2132	East Bay Energy Watch	2.2	1.19	2.73	1.47
PGE2133	Fresno County Energy Watch	2.21	0.87	3.49	1.38
PGE2134	Kern County Energy Watch	1.17	0.58	1.23	0.62
PGE2135	Madera County Energy Watch	1.86	0.78	3.39	1.42
PGE2136	Marin County Energy Watch	1.13	0.62	1.52	0.83
PGE2137	Mendocino County Energy Watch	0.72	0.3	0.86	0.35
PGE2138	Napa County Energy Watch	1.05	0.64	1.48	0.91
PGE2139	Redwood Energy Watch	1.5	0.9	1.6	0.96
PGE2140	San Joaquin County Energy Watch	1.51	0.76	1.59	0.8
PGE2141	San Luis Obispo County Energy Watch	1.01	0.51	1.05	0.53
PGE2142	San Mateo County Energy Watch	1.01	0.48	1.35	0.65
PGE2143	Santa Barbara County Energy Watch	1.03	0.55	1.09	0.58
PGE2144	Sierra Nevada Energy Watch	1.22	0.61	1.59	0.79
PGE2145	Sonoma County Energy Watch	0.76	0.44	1.52	0.88
PGE2146	Silicon Valley Energy Watch	1.19	0.58	1.51	0.74
PGE2147	San Francisco Energy Watch	1.76	1.24	1.86	1.31
PGE2176	California New Homes Multifamily	0.9	0.9	0.88	0.88
PGE2177	Enhance Time Delay Relay	0.74	0.74	0.79	0.79
PGE2178	ENERGY STAR Manufactured Homes	0.66	0.66	0.78	0.78
PGE2179	Direct Install for Manufactured and Mobile Homes	1.98	1.98	1.98	1.98
PGE2181	Air Care Plus	1.92	1.41	2.12	1.56
PGE2182	Boiler Energy Efficiency Program	1.01	0.75	1.7	1.26
PGE2183	Comprehensive Retail Energy Management	1.16	0.47	1.39	0.57
PGE2185	EnergySmart Grocer	1.65	1.61	2.64	2.58
PGE2186	Enhanced Automation Initiative	5.18	2.76	6.13	3.26
PGE2187	Monitoring-Based Persistence Commissioning	1.06	0.5	1.68	0.78
PGE2189	Cool Controls Plus	1.99	1.96	1.99	1.96
PGE2190	LodgingSavers	1.55	1.07	1.56	1.07
PGE2191	Medical Building Tune-Up	1.14	0.49	1.2	0.52
PGE2193	School Energy Efficiency	0.93	0.74	1.32	1.05
PGE2194	Energy Fitness Program	2.44	0.93	4.08	1.56
PGE2195	Energy Savers	1.66	1.09	1.96	1.28

		Total Resource Cost		Program Administration Cost	
ProgramID	Program Name	Reported	Evaluated	Reported	Evaluated
PGE2196	RightLights	2.27	1.01	2.27	1.01
PGE2197	Small Business Commercial Comprehensive	2.03	1.37	2.03	1.37
PGE2198	DCCCP Quest	1.42	0.69	1.71	0.84
PGE2199	Energy-Efficient Parking Garage	1.37	1.35	1.58	1.56
PGE2200	Furniture Store Energy Efficiency	1.07	0.46	1.07	0.46
PGE2201	High Performance Office Lighting	1.63	1.61	1.49	1.48
PGE2202	LED Accelerator	1.23	1.2	1.06	1.03
PGE2203	Monitoring-Based Commissioning	-	-	-	-
PGE2204	SmartVent for Energy-Efficient Kitchens	1.23	1.23	1.23	1.23
PGE2205	Casino Green	1.89	1.08	1.91	1.09
PGE2206	Healthcare Energy Efficiency Program	0.39	0.2	0.44	0.23
PGE2209	Ozone Laundry Energy Efficiency	1.26	0.75	1.46	0.87
PGE2210	Cool Schools	-	-	-	-
PGE2212	California Preschool Energy Efficiency Program	1.31	0.54	1.31	0.54
PGE2213	K-12 Private Schools and Colleges Audit Retro	0.65	0.32	0.81	0.4
PGE2214	EE Entertainment Centers	0.98	0.96	1.02	1
PGE2220	AIM Compressed Air Efficiency	1.05	0.47	1.13	0.51
PGE2221	California Wastewater Process Optimization	0.95	0.47	1.36	0.67
PGE2222	Energy Efficiency Services for Oil Production	1.5	0.74	3.86	1.9
PGE2223	Heavy Industry Energy Efficiency Program	1.8	1.02	2.24	1.27
PGE2224	Industrial Compressed Air	2.16	0.97	2.32	1.04
PGE2225	Refinery Energy Efficiency Program	2.07	1.31	5.15	3.25
PGE2227	Cement Production and Distribution Energy Efficiency	0.06	0.03	0.07	0.03
PGE2228	Industrial Recommissioning Program	1.3	0.68	1.35	0.71
PGE2230	Dairy Energy Efficiency Program	0.76	0.71	1.83	1.7
PGE2231	Industrial Refrigeration Performance Plus	0.76	0.39	2.31	1.18
PGE2232	Light Exchange Program	1.18	1.16	1.18	1.16
PGE2233	Wine Industry Efficiency Solutions	0.79	0.57	1.23	0.9
PGE2234	Comprehensive Food Process Audit & Resource Efficiency Pgm	1.52	0.79	2.08	1.09
PGE2235	Dairy Industry Resource Advantage Pgm	1.42	0.75	1.69	0.89
PGE2236	Process Wastewater Treatment EM Pgm for Ag Food Processing	2.85	1.28	3.25	1.46
PGE2240	Builder Energy Code Training	-	-	-	-
PGE2241	Green Building Technical Support Services	-	-	-	-
PGE2242	Cool Cash	0.33	0.13	0.38	0.15

Table E-2 SCE Savings, Cost Effectiveness and Emissions Reductions by Program

		Total Resource Cost		Program Administration Cost	
ProgramID	**Program Name**	**Reported**	**Evaluated**	**Reported**	**Evaluated**
SCE-L-001	On-Line Buyer's Guide	-	-	-	-
SCE-L-002	Financial Solutions	-	-	-	-
SCE-L-003	Integrated Demand Side Management Pilot for Food Processing	-	-	-	-
SCE-L-004A	City of Beaumont Energy Leader Partnership	0.26	0.15	0.27	0.16
SCE-L-004B	City of Long Beach Energy Leader Partnership	1.15	0.82	1.56	1.11
SCE-L-004C	City of Redlands Energy Leader Partnership	0.57	0.31	0.84	0.46
SCE-L-004D	City of Ridgecrest Energy Leader Partnership	0.01	0.01	0.01	0.01
SCE-L-004E	City of Santa Ana Energy Leader Partnership	0.43	0.32	1.01	0.77
SCE-L-004F	City of Simi Valley Energy Leader Partnership	0.52	0.32	0.6	0.37
SCE-L-004G	City of South Gate Energy Leader Partnership	0.11	0.09	0.28	0.23
SCE-L-004H	Community Energy Leader Partnership	0.76	0.53	1.39	0.97
SCE-L-004I	Desert Cities Energy Leader Partnership	0.72	0.6	1.25	1.05
SCE-L-004J	Eastern Sierra Energy Leader Partnership	0.06	0.05	0.06	0.05
SCE-L-004K	Energy Leader Partnership Strategic Support	-	-	-	-
SCE-L-004L	Kern County Energy Leader Partnership	0.38	0.24	0.4	0.25
SCE-L-004M	Orange County Cities Energy Leader Partnership	0.57	0.33	1.81	1.04
SCE-L-004N	Palm Desert Demonstration Partnership	0.62	0.49	0.78	0.61
SCE-L-004O	San Gabriel Valley Energy Leader Partnership	1.04	0.79	2.05	1.56
SCE-L-004P	San Joaquin Valley Energy Leader Partnership	0.97	0.56	1.75	1.01
SCE-L-004Q	South Bay Energy Leader Partnership	0.59	0.39	1.08	0.71
SCE-L-004R	South Santa Barbara County Energy Leader Partnership	0.26	0.19	0.45	0.33
SCE-L-004Rollup	Energy Leader Partnership Program	-	-	-	-
SCE-L-004S	Ventura County Energy Leader Partnership	0.54	0.31	0.82	0.48
SCE-L-004T	Local Government Strategic Planning Pilot Program	-	-	-	-
SCE-L-004U	Western Riverside Energy Leader Partnership	0.65	0.44	0.84	0.57
SCE-L-004V	City of Adelanto Energy Leader Partnership	0.17	0.1	0.48	0.3
SCE-L-004W	West Side Energy Leader Partnership	1.18	1.06	2.72	2.43
SCE-L-005A	California Community Colleges Energy Efficiency Partnership	0.67	0.44	1.74	1.14
SCE-L-005B	California Department of Corrections and Rehabilitation Energy Efficiency Partnership	0.6	0.37	1.35	0.83
SCE-L-005C	County of Los Angeles Energy Efficiency Partnership	0.67	0.33	1.94	0.97

		Total Resource Cost		Program Administration Cost	
ProgramID	**Program Name**	**Reported**	**Evaluated**	**Reported**	**Evaluated**
SCE-L-005D	County of Riverside Energy Efficiency Partnership	0.69	0.41	0.77	0.45
SCE-L-005E	County of San Bernardino Energy Efficiency Partnership	0.73	0.53	1.27	0.91
SCE-L-005F	State of California Energy Efficiency Partnership	1.06	0.65	2.1	1.28
SCE-L-005G	UC/CSU Energy Efficiency Partnership	0.99	0.59	2.33	1.39
SCE-L-005Rollup	IGREEN	-	-	-	-
SCE-L-006	Integrated Marketing & Outreach	-	-	-	-
SCE-SW-001A	Home Energy Efficiency Survey Program	0.88	1	1.61	1.85
SCE-SW-001B	Residential Lighting Incentive Program for Basic CFLs	6.48	8.12	9.15	11.46
SCE-SW-001C	Advanced Consumer Lighting Program	3.08	3.06	5.74	5.7
SCE-SW-001D	Home Energy Efficiency Rebate Program	1.14	1.14	1.26	1.26
SCE-SW-001E	Appliance Recycling Program	1.53	1.03	1.53	1.03
SCE-SW-001F	Business and Consumer Electronics Program	2.9	2.85	4	3.94
SCE-SW-001G	Multifamily Energy Efficiency Rebate Program	1.3	1.3	1.15	1.15
SCE-SW-001H	Whole House Prescriptive Program	0.03	0.04	0.03	0.04
SCE-SW-002A	Non-Residential Audits	-	-	-	-
SCE-SW-002B	Calculated Incentives Program	1.05	0.62	3.27	1.92
SCE-SW-002C	Deemed Incentives Program	1.37	0.84	3.9	2.39
SCE-SW-002D	Commercial Direct Install Program	1.94	0.9	1.94	0.9
SCE-SW-002E	Continuous Energy Improvement	-	-	-	-
SCE-SW-003A	Industrial Energy Audit Program	-	-	-	-
SCE-SW-003B	Industrial Calculated Energy Efficiency Program	1.5	0.79	3.98	2.09
SCE-SW-003C	Industrial Deemed Energy Efficiency Program	1.44	0.74	3.57	1.82
SCE-SW-003D	Industrial Continuous Energy Improvement Program	-	-	-	-
SCE-SW-004A	Agriculture Energy Audit Program	-	-	-	-
SCE-SW-004B	Agriculture Calculated Energy Efficiency Program	1.22	0.67	2.66	1.46
SCE-SW-004C	Agriculture Deemed Energy Efficiency Program	1.01	0.59	1.86	1.09
SCE-SW-004D	Agriculture Continuous Energy Improvement Program	-	-	-	-
SCE-SW-004E	Pump Test Services Program	0.82	0.82	2.08	2.08
SCE-SW-005A	Savings By Design	2.41	1.44	3.59	2.14
SCE-SW-005B	California Advanced Homes	0.4	0.4	0.39	0.39
SCE-SW-005C	Energy Star Manufactured Housing	-	-	-	-
SCE-SW-006	Statewide Lighting Market Transformation Program	-	-	-	-
SCE-SW-007A	Upstream HVAC Equipment Incentive	0.99	1.11	2.09	2.35

		Total Resource Cost		Program Administration Cost	
ProgramID	**Program Name**	**Reported**	**Evaluated**	**Reported**	**Evaluated**
SCE-SW-007B	HVAC Technologies and System Diagnostics Advocacy	-	-	-	-
SCE-SW-007C	Commercial Quality Installation	-	-	-	-
SCE-SW-007D	ENERGY STAR Residential Quality Installation Program	0.02	0.01	0.07	0.03
SCE-SW-007E	Residential Quality Maintenance and Commercial Quality Maintenance Development	0.23	0.17	0.22	0.17
SCE-SW-007F	HVAC Workforce Education & Training	-	-	-	-
SCE-SW-008	CFL Adjustment	-	-	-	-
SCE-SW-009A	Technology Assessments	-	-	-	-
SCE-SW-009B	Scaled Field Placements	-	-	-	-
SCE-SW-009C	Demonstration Showcases	-	-	-	-
SCE-SW-009D	Market and Behavioral Studies	-	-	-	-
SCE-SW-009E	Technology Development Support	-	-	-	-
SCE-SW-009F	Business Incubation Support	-	-	-	-
SCE-SW-009G	Technology Test Centers	-	-	-	-
SCE-SW-009Rollup	Program Mgmt & CPUC Reporting	-	-	-	-
SCE-SW-010A	WE&T Centergies	-	-	-	-
SCE-SW-010B	WE&T Connections	0.42	0.42	0.42	0.42
SCE-SW-010C	WE&T Planning	-	-	-	-
SCE-SW-011A	Statewide ME&O	-	-	-	-
SCE-SW-011B	ME&O Strategic Plan	-	-	-	-
SCE-SW-012	Integrated DSM	-	-	-	-
SCE-SW-CFL	CFL Adjustment	-	-	-	-
SCE-TP-001	Efficient Affordable Housing	-	-	-	-
SCE-TP-002	Comprehensive Mobile Home	1.13	1.13	1.13	1.13
SCE-TP-003	Comprehensive Home Performance	0.05	0.03	0.06	0.04
SCE-TP-004	Community Language Efficiency Outreach	-	-	-	-
SCE-TP-005	Cool Planet	-	-	-	-
SCE-TP-006	Healthcare EE Program (HEEP)	0.77	0.41	1.93	1.02
SCE-TP-007	Livestock Industry Resource Advantage	-	-	-	-
SCE-TP-008	Comprehensive Beverage Manufacturing and Resource Efficiency	0.48	0.24	1.84	0.9
SCE-TP-009	Solid Waste Energy Efficiency Program	-	-	-	-
SCE-TP-010	Data Center Energy Efficiency	0.73	0.45	1.09	0.68
SCE-TP-011	Data Center Optimization	-	-	-	-
SCE-TP-012	Lodging EE Program (LEEP)	1	0.56	2.15	1.22
SCE-TP-013	Food & Kindred Products	1.63	0.8	2.43	1.19

		Total Resource Cost		Program Administration Cost	
ProgramID	**Program Name**	**Reported**	**Evaluated**	**Reported**	**Evaluated**
SCE-TP-014	Primary and Fabricated Metals	1.99	0.89	3.12	1.39
SCE-TP-015	Industrial Gasses	1.15	0.64	1.39	0.77
SCE-TP-016	Nonmetallic Minerals and Products	1.3	0.68	2.41	1.26
SCE-TP-017	Comprehensive Chemical Products	0.45	0.25	0.52	0.28
SCE-TP-018	Chemical Products Efficiency Program (CPEP)	0.69	0.34	0.82	0.4
SCE-TP-019	Comprehensive Petroleum Refining	0.23	0.12	0.24	0.13
SCE-TP-020	Oil Production	1.95	1.04	3.08	1.64
SCE-TP-021	Refinery Energy Efficiency Program (REEP)	3.2	1.36	3.55	1.51
SCE-TP-023	Cool Schools	0.29	0.23	0.42	0.32
SCE-TP-024	Public Pre-Schools, Elementary Schools and High Schools	1.93	0.82	1.93	0.82
SCE-TP-025	Retail Energy Action Program (REAP)	0.74	0.6	1.58	1.3
SCE-TP-026	Commercial Utility Building Efficiency (CUBE)	0.79	0.43	1.43	0.78
SCE-TP-027	Monitoring-Based Commissioning (MBx)	-	-	-	-
SCE-TP-028	Monitoring-Based Persistence Commissioning Program (MBPCx)	-	-	-	-
SCE-TP-030	Sustainable Portfolios	-	-	-	-
SCE-TP-031	Management Affiliates Program (MAP)	1.01	0.61	1.6	0.96
SCE-TP-032	Private College Campus Housing	-	-	-	-
SCE-TP-033	Automatic Energy Review for Schools	4.55	2.45	5.71	3.07
SCE-TP-034	Sustainable Communities	-	-	-	-
SCE-TP-036	Energy Efficiency for Entertainment Centers	1.84	1.66	1.84	1.66
SCE-TP-037	Private Schools and Colleges Program	1.65	0.69	1.65	0.69
SCE-TP-038	California Preschools Program (CPEEP)	1.13	0.46	1.13	0.46
SCE-TP-0608	Coin Operated Laundry Program	0.86	0.38	0.89	0.39

Table E-3 SCG Savings, Cost Effectiveness and Emissions Reductions by Program

		Total Resource Cost		Program Administration Cost	
ProgramID	**Program Name**	**Reported**	**Evaluated**	**Reported**	**Evaluated**
SCG3600	Local02 - Local Whole Home Performance	0.27	0.14	0.43	0.22
SCG3601	Local05 - Local Non-Residential BID	2.02	2.44	6.37	7.71
SCG3602	SW-AgA - Calculated	1.69	2.04	3.48	4.22
SCG3603	SW-AgB - Deemed	0.92	0.92	1.07	1.07
SCG3604	SW-AgC - Nonresidential Audits	-	-	-	-
SCG3605	SW-AgD - Pump Test & Repair	-	-	-	-
SCG3606	SW-AgE - Continuous Energy Improvement	-	-	-	-

		Total Resource Cost		Program Administration Cost	
ProgramID	Program Name	Reported	Evaluated	Reported	Evaluated
SCG3607	SW-ComA - Calculated	0.93	1.11	4.39	5.26
SCG3608	SW-ComB - Deemed	0.87	0.87	1.01	1.01
SCG3609	SW-ComC - Nonresidential Audits	-	-	-	-
SCG3610	SW-ComD - Continuous Energy Improvement	-	-	-	-
SCG3611	SW-IndA - Calculated	2.39	2.9	7.08	8.57
SCG3612	SW-IndB - Deemed	5.23	5.98	7.4	8.46
SCG3613	SW-IndC - Nonresidential Audits	-	-	-	-
SCG3614	SW-IndD - Continuous Energy Improvement	-	-	-	-
SCG3615	SW-ResA - Multifamily EE Rebates	1.08	1.08	1.73	1.73
SCG3616	SW-ResB - Home Efficiency Rebates	0.84	0.84	2.67	2.67
SCG3617	SW-ResC - Home Efficiency Energy Survey	-	-	-	-
SCG3618	SW-ResD - Prescriptive Whole House Retrofit	0.01	0.01	0.01	0.01
SCG3619	L-InstP01 - CA Depart of Corrections Partnership	-	-	-	-
SCG3620	L-InstP02 - CA Community College Partnership	-	-	-	-
SCG3621	L-InstP03 - UC/CSU/IOU Partnership	-	-	-	-
SCG3622	L-InstP04 - State of California /IOU Partnership	-	-	-	-
SCG3623	SW-ME&OB - SW Marketing, E&O FYP	-	-	-	-
SCG3624	SW-ETA - Assessments	-	-	-	-
SCG3625	SW-NCNR - NRNC Savings By Design	1.27	1.06	2.39	1.99
SCG3626	SW-NCResA - RNC	0.4	0.4	0.59	0.59
SCG3627	SW-WE&TA - Strategic Planning & Implementation	-	-	-	-
SCG3628	SW-WE&TB - WE&T Centers	-	-	-	-
SCG3629	SW-WE&TC - WE&T Connections	-	-	-	-
SCG3630	LGovP01 - LA County IOU Partnership	-	-	-	-
SCG3631	LGovP02 - Kern County Energy Watch Partnership	-	-	-	-
SCG3632	LGovP03 - Riverside County Partnership	-	-	-	-
SCG3633	LGovP04 - San Bernardino County IOU Partnership	-	-	-	-
SCG3634	LGovP05 - Santa Barbara County IOU Partnership	-	-	-	-
SCG3635	LGovP06 - SBCCOG Partnership	-	-	-	-
SCG3636	LGovP07 - San Luis Obispo County Partnership	-	-	-	-

		Total Resource Cost		Program Administration Cost	
ProgramID	Program Name	Reported	Evaluated	Reported	Evaluated
SCG3637	LGovP08 - Tulare Cnty-Visalia Energy Watch Prtnr	-	-	-	-
SCG3638	LGovP09 - Orange County Cities Partnership	-	-	-	-
SCG3639	LGovP10 - ILG IOU Partnership	-	-	-	-
SCG3640	LGovP11 - Community Energy Partnership	-	-	-	-
SCG3641	LGovP12 - Desert Cities Partnership	-	-	-	-
SCG3642	LGovP13 - VCREA Sub-Program Partnership	-	-	-	-
SCG3643	LGovP14 - Palm Desert IOU Pilot Partnership	-	-	-	-
SCG3644	Local01 - OBF	-	-	-	-
SCG3645	Local03 - Local Sustainable Communities (RMV)	-	-	-	-
SCG3646	Local04 - Local Strategic Develop & Integ	-	-	-	-
SCG3651	SW-HVACA - Residential Energy Star Quality Insta	-	-	-	-
SCG3652	SW-HVACB - Commercial Quality Installation	-	-	-	-
SCG3653	SW-HVACC - Commercial Upstream Equipment	-	-	-	-
SCG3654	SW-HVACD - Quality Maintenance Program	-	-	-	-
SCG3655	SW-HVACE - Technology & Systems Diagnostics	-	-	-	-
SCG3656	SW-HVACF - HVAC WE&T	-	-	-	-
SCG3657	SW-HVACG - HVAC Core	-	-	-	-
SCG3658	SW-IDSM - SW Integrated DSM	-	-	-	-
SCG3659	SW-ME&O C - ME&O Strategic Plan	-	-	-	-
SCG3660	3P-NRes1 - Steam Trap and Compressed Air Survey	-	-	-	-
SCG3661	3P-NRes2 - Energy Challenger	-	-	-	-
SCG3662	3P-NRes3 - Small Industrial Facility Upgrades	0.44	0.47	0.83	0.87
SCG3663	3P-NRes4 - Program for Resource Efficiency in Private Schools	1.07	1.1	1.27	1.31
SCG3664	3P-Res01 - On Demand Efficiency	1.65	1.65	2.08	2.08
SCG3665	3P-Res02 - HERS Rater Training Advancement	-	-	-	-
SCG3666	3P-Res03 - Multifamily Home Tune-Up	1.26	1.26	1.53	1.53
SCG3667	3P-Res04 - Multifamily Solar Pool Heating	0.14	0.14	0.15	0.15
SCG3668	3P-Res05 - Community Language Effic Outreach	-	-	-	-
SCG3669	3P-Res06 - Multifamily Direct Therm Savings	1.59	1.59	1.7	1.7
SCG3670	3P-Res07 - LivingWise	3.53	3.53	4.27	4.27

		Total Resource Cost		Program Administration Cost	
ProgramID	**Program Name**	**Reported**	**Evaluated**	**Reported**	**Evaluated**
SCG3671	3P-Res09 - Manufactured Mobile Home	2.16	2.16	2.23	2.23
SCG3672	3P-Xc01 - Gas Cooling Retrofit	0.17	0.17	0.18	0.18
SCG3673	3P-Xc02 - SaveGas Hot Water Control	2.36	2.36	2.36	2.36
SCG3674	3P-Xc03 - Upstream High Efficiency Gas Water Heater	0.6	0.6	2.56	2.56
SCG3675	3P-Xc04 - California Sustainability Alliance	-	-	-	-
SCG3676	3P-Xc05 - Portfolio of the Future (PoF)	-	-	-	-
SCG3677	3P-Xc06 - PACE Energy Savings Project	-	-	-	-

Table E-4 SD&E Savings, Cost Effectiveness and Emissions Reductions by Program

		Total Resource Cost		Program Administration Cost	
ProgramID	**Program Name**	**Reported**	**Evaluated**	**Reported**	**Evaluated**
SDGE3100	SW-AgA - Calculated	0.39	0.2	0.54	0.29
SDGE3101	SW-AgB - Deemed	1.05	0.89	1.23	1.05
SDGE3102	SW-AgC - Nonresidential Audits	-	-	-	-
SDGE3103	SW-AgD - Pump Test & Repair	-	-	-	-
SDGE3104	SW-AgE - Continuous Energy Improvement	-	-	-	-
SDGE3105	SW-ComA - Calculated	1.32	0.97	4.83	3.54
SDGE3106	SW-ComB - Deemed	1.6	1.15	4.34	3.11
SDGE3107	SW-ComC - Nonresidential Audits	-	-	-	-
SDGE3108	SW-ComD - Continuous Energy Improvement	-	-	-	-
SDGE3109	SW-IndA - Calculated	1.12	0.72	2.93	1.89
SDGE3110	SW-IndB - Deemed	2.03	1.24	3.2	1.96
SDGE3111	SW-IndC - Nonresidential Audits	-	-	-	-
SDGE3112	SW-IndD - Continuous Energy Improvement	-	-	-	-
SDGE3113	SW-ResA - Residential Basic Lighting	4.39	4.37	5.09	5.07
SDGE3114	SW-ResB - Advanced Consumer Lighting	2.24	2.04	3.93	3.59
SDGE3115	SW-ResG - Business/Consumer Electronics/ Plug Load	0.7	0.68	1.58	1.55
SDGE3116	Local01 - Local Whole House Perfomance	0.74	0.33	0.78	0.35
SDGE3117	Local03 - Local Non-Residential (BID)	1.71	1.16	4.19	2.84
SDGE3118	SW-NCNR - NRNC Savings By Design	2.02	1.13	3.15	1.77
SDGE3119	SW-ResC - Multi-Family	0.93	0.93	1.31	1.31
SDGE3120	SW-NCResB - E-Star Manufactured Homes	0.02	0.02	0.02	0.02

		Total Resource Cost		Program Administration Cost	
ProgramID	Program Name	Reported	Evaluated	Reported	Evaluated
SDGE3121	SW-ResD - Home Efficiency Rebates	0.72	0.72	1.9	1.89
SDGE3122	SW-ResE - Home Efficiency Surveys	-	-	-	-
SDGE3123	L-InstP01 - CA Depart of Corrections Partnership	-	-	-	-
SDGE3124	L-InstP02 - CA Community College Partnership	-	-	-	-
SDGE3125	L-InstP03 - UC/CSU/IOU Partnership	-	-	-	-
SDGE3126	L-InstP04 - State of California /IOU Partnership	-	-	-	-
SDGE3127	L-InstP05 - University of San Diego Partnership	-	-	-	-
SDGE3128	L-InstP06 - San Diego Cnty Water Auth Partnership	-	-	-	-
SDGE3129	LGovP01 - City of Chula Vista Partnership	-	-	-	-
SDGE3130	LGovP02 - City of San Diego Partnership	-	-	-	-
SDGE3131	LGovP03 - County of San Diego Partnership	-	-	-	-
SDGE3132	LGovP04 - City of San Juan Capistrano Partnership	-	-	-	-
SDGE3133	LGovP05 - Port of San Diego Partnership	-	-	-	-
SDGE3134	LGovP06 - SANDAG Partnership	-	-	-	-
SDGE3135	LGovP07 - ICLEI Partnership	-	-	-	-
SDGE3136	LGovP08 - New Cities Partnership	-	-	-	-
SDGE3137	Local02 - Local Island Program	0.42	0.42	0.42	0.42
SDGE3138	Local04 - Local Sustainable Communities (RMV)	-	-	-	-
SDGE3139	Local05 - OBF	-	-	-	-
SDGE3140	Local06 - Local Strategic Development & Integrat	-	-	-	-
SDGE3145	SW-HVACA - Residential Energy Star Quality Instal	-	-	-	-
SDGE3146	SW-HVACB - Commercial Quality Installation	-	-	-	-
SDGE3147	SW-HVACC - Commercial Upstream Equipment	-	-	-	-
SDGE3148	SW-HVACD - Quality Maintenance Program	-	-	-	-
SDGE3149	SW-HVACE - Technology & Systems Diagnostics	-	-	-	-
SDGE3150	SW-HVACF - HVAC WE&T	-	-	-	-
SDGE3151	SW-HVACG - HVAC Core	-	-	-	-

		Total Resource Cost		Program Administration Cost	
ProgramID	Program Name	Reported	Evaluated	Reported	Evaluated
SDGE3152	SW-IDSM - SW Integrated DSM	-	-	-	-
SDGE3153	SW Marketing, E&O FYP	-	-	-	-
SDGE3154	SW-ME&O C - Strategic Plan	-	-	-	-
SDGE3155	SW-ETA - Assessments	-	-	-	-
SDGE3156	SW-ResH - Prescriptive Whole House Retrofit	0.26	0.16	0.26	0.16
SDGE3157	SW-WE&TA - Strategic Planning & Implementation	-	-	-	-
SDGE3158	SW-WE&TB - WE&T Centers – SDERC, Food Service Cen	-	-	-	-
SDGE3159	SW-WE&TC - WE&T Connections – PEAK Program	-	-	-	-
SDGE3160	SW-NCResA - RNC	0.4	0.4	0.51	0.51
SDGE3161	3P-NRes01 - Non-Res HVAC Tune-up/ Quality Installa	1.13	0.98	1.62	1.42
SDGE3162	3P-NRes02 - SaveGas Hot Water Control	2.05	2.05	2.27	2.27
SDGE3163	3P-NRes03 - Business Energy Assessment (BEA)	-	-	-	-
SDGE3164	3P-NRes06 - Energy Efficient Water Pumping	-	-	-	-
SDGE3165	3P-NRes07 - Healthcare Energy Efficiency Program	-	-	-	-
SDGE3166	3P-NRes08 - Lodging Energy Efficiency Program	-	-	-	-
SDGE3167	3P-NRes09 - Mobile Energy Clinic (MEC)	0.81	0.71	0.83	0.72
SDGE3168	3P-NRes11 - Portfolio of the Future (PoF)	-	-	-	-
SDGE3169	3P-NRes12 - Comprehensive Industrial Energy Effic	-	-	-	-
SDGE3170	3P-NRes13 - Retro Commissioning (RCx)	2.91	1.27	3.56	1.55
SDGE3171	3P-Res01 - Res HVAC Tune-up/Quality Installation	0.45	0.45	0.54	0.54
SDGE3172	3P-Res02 - Comprehensive Mobile Home (SW)	0.88	0.88	1.24	1.24
SDGE3173	3P-Res04 - K-12 Energy Efficiency Education (E3)	-	-	-	-
SDGE3174	SW-ComE - Direct Install	1.36	0.74	1.37	0.75
SDGE3175	SW-ResF - Appliance Recycling	1.08	0.58	1.46	0.79
SDGE3176	Kitchen Learning Center	-	-	-	-

		Total Resource Cost		Program Administration Cost	
ProgramID	**Program Name**	**Reported**	**Evaluated**	**Reported**	**Evaluated**
SDGE3177	EM&V-Evaluation Measurement & Verification	-	-	-	-
SDGE3178	LGovP10 - County of San Diego - ARRA Continued Programs	-	-	-	-
SDGE3179	LGovP09 - City of San Diego - ARRA Continued Programs	-	-	-	-

Appendix F: Lifecycle Savings

The investments in energy efficiency from the 2010-2012 portfolio and prior program cycles will have direct effects for a number years to come as measures continue to deliver savings. This appendix presents, by market sector, the savings through 2032 that result from 2010-2012 and prior utility portfolios. Note that the savings impacts presented in this appendix do not include results of the utilities' codes and standards advocacy efforts, which arguably have the longest term effect of any intervention as they are incorporated into building practice and appliances.

The lifecycle savings impacts from the 2010-2012 energy efficiency programs are modeled based on the energy savings estimates made during the program cycle and multiplied by the expected useful lives of the installed technologies. This modeling exercise has several limitations. First, the estimates of lifecycle savings impacts are not a comprehensive picture of the expected savings over time, as energy savings technologies installed during the 2010-2012 program cycle may be affected by changes in economic activity (affecting production rates) and/or early expiration of technologies due to either remodeling or technology failures. Second, evaluated savings in any given program cycle are based on observed post-installation conditions, they do not necessarily represent the future conditions. Third, these estimates do not include consideration of the potential for declining performance from aged equipment or long term program influence on market factors. Nevertheless, these are the best estimates currently available for projecting the long-term potential impacts of the technologies installed and actions taken in 2010-2012.

It is important to note that none of the savings estimates included in this report, claimed or evaluated, include long term market effects of the energy efficiency programs, either prospectively or retrospectively. Long term market effects can include program effects on end user decision making (e.g. changes in knowledge and awareness), trade ally practices (e.g. changes in product availability and marketing), and changes in energy efficiency product and service characteristics (e.g. changes in product costs and features). The primary focus of the 2010-2012 impact evaluations was on the estimation of the immediate and direct impacts of the 2010-2012 programs. While several other studies have supplemented this information to understand market effects, no updates to impacts are made based on those results

The Commission reported on the sustained influence of the 2006-2008 and 2009 program activities, and these impacts are included in the illustrations in this section. While some of the technologies installed during that period are no longer providing benefits, many still are installed and operating.

The "mountain-like" shape of the electricity and demand curves show the buildup of measures and savings and then a decline over time if no new investment or activity is included. The observed decrease in energy savings over time is referred to as "measure

savings decay." The steeper the drop off after the end of the program cycle (2012) indicates a short measure life for many of the investments. A flatter curve after the end of the program cycle (observe the commercial wedge) the longer life the installed measures are expected to have, hence a longer term investment.

The natural gas savings have a pattern that may have a dip and then a rebound in later years. The increase in natural gas savings corresponds with the expiration of lighting measures that cause negative HVAC interactive effects. Since no long term adoption or replacement of the lighting and appliance technologies is modeled, the savings from natural gas measures with greater longevity re-appear in the graphic around 2016.

Figure F-1 Statewide Lifecycle Savings (GWh) by Sector, 2006-2012

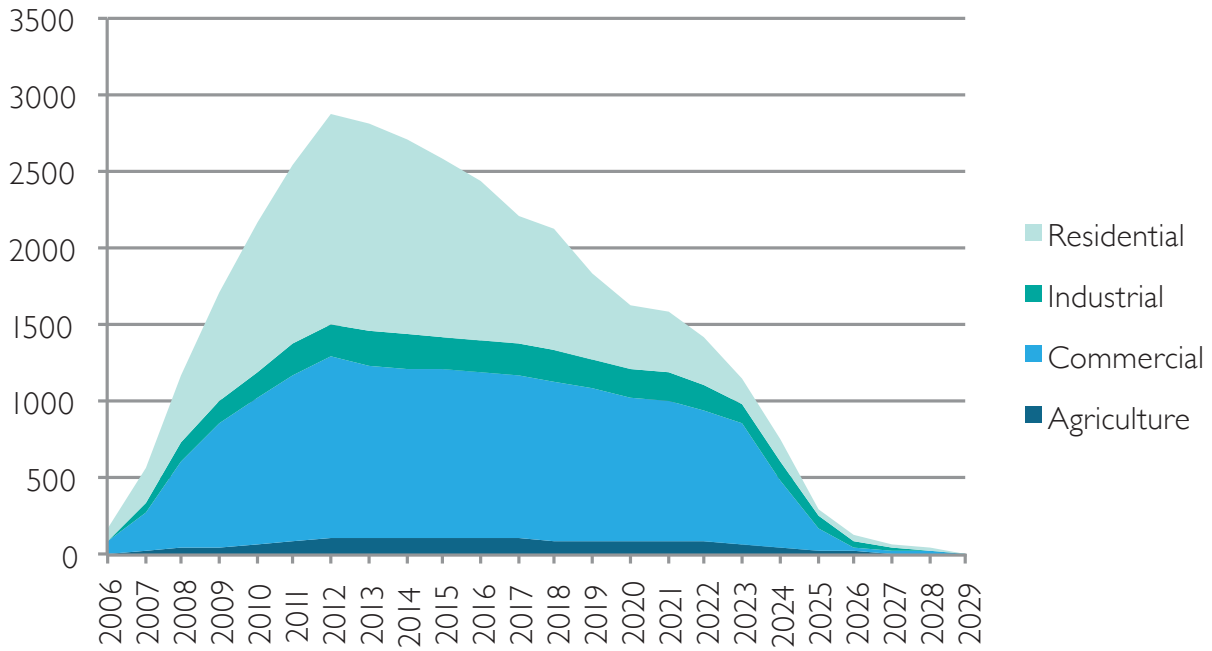
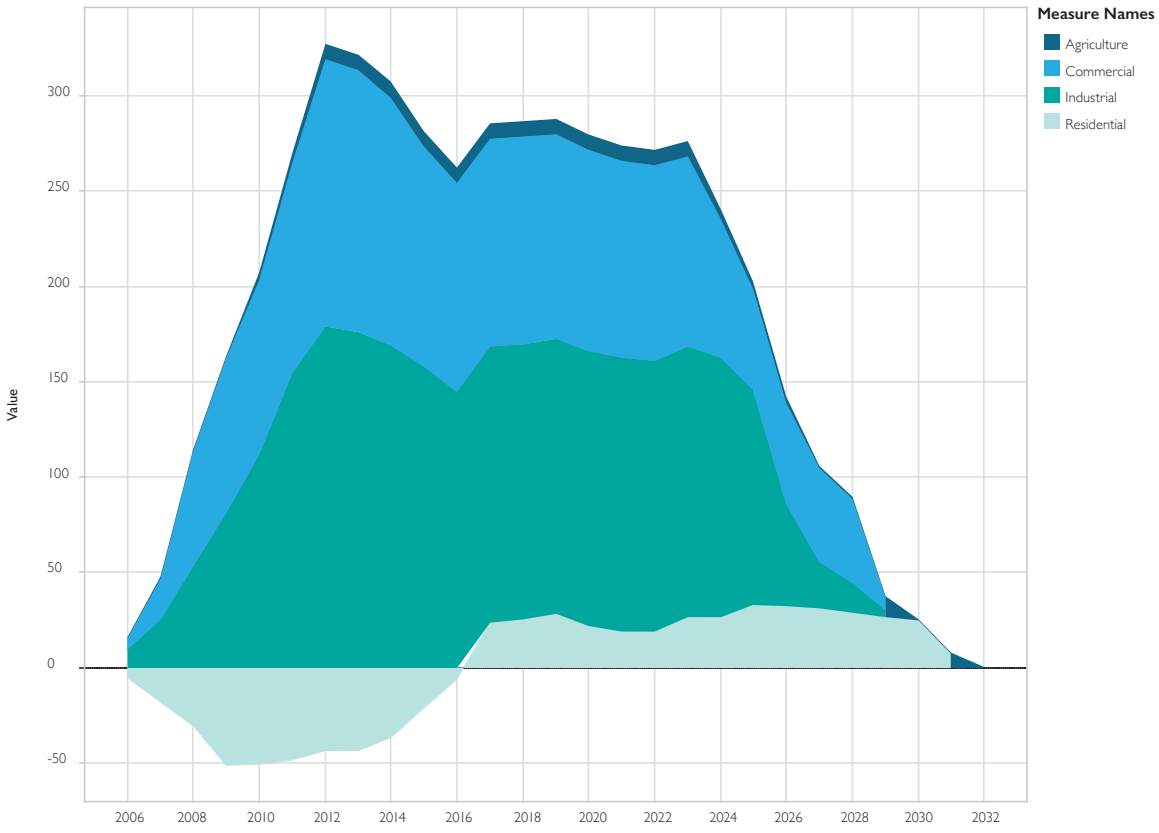


Figure F-2 Statewide Lifecycle Savings (MMTherms) by Sector, 2006-2012



PG&E

Figure F-3 PG&E Lifecycle Savings (GWh) by Sector, 2006-2012

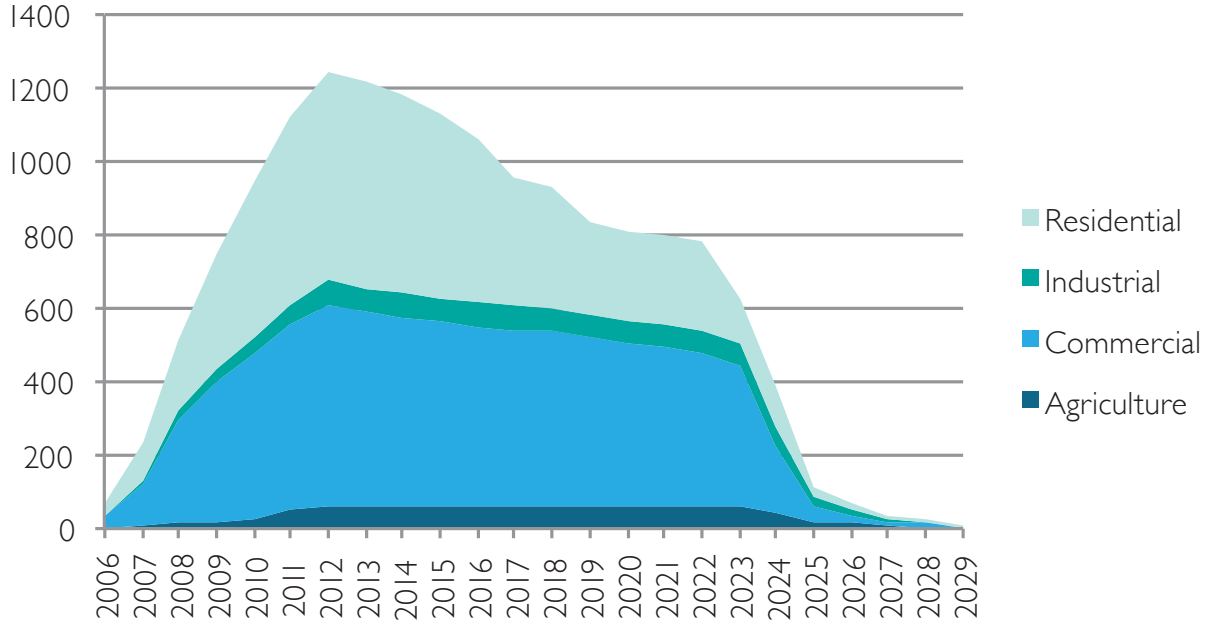
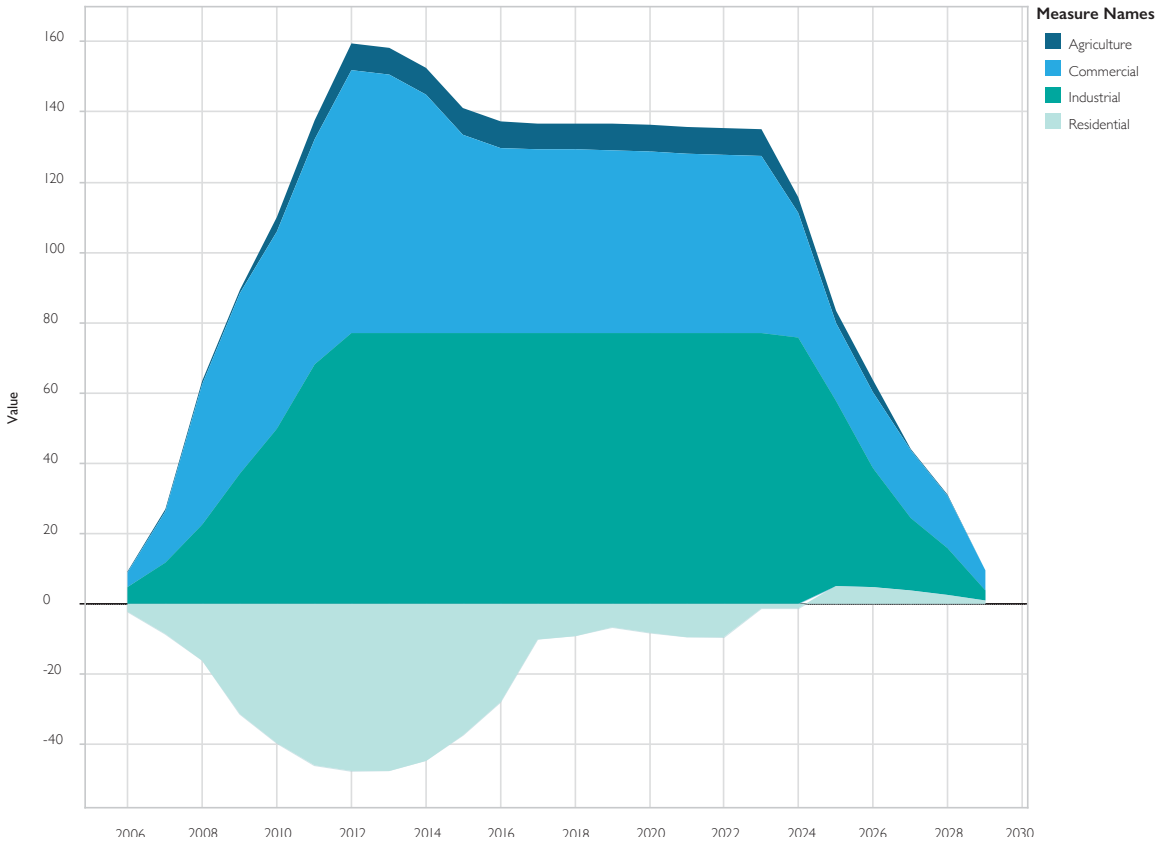
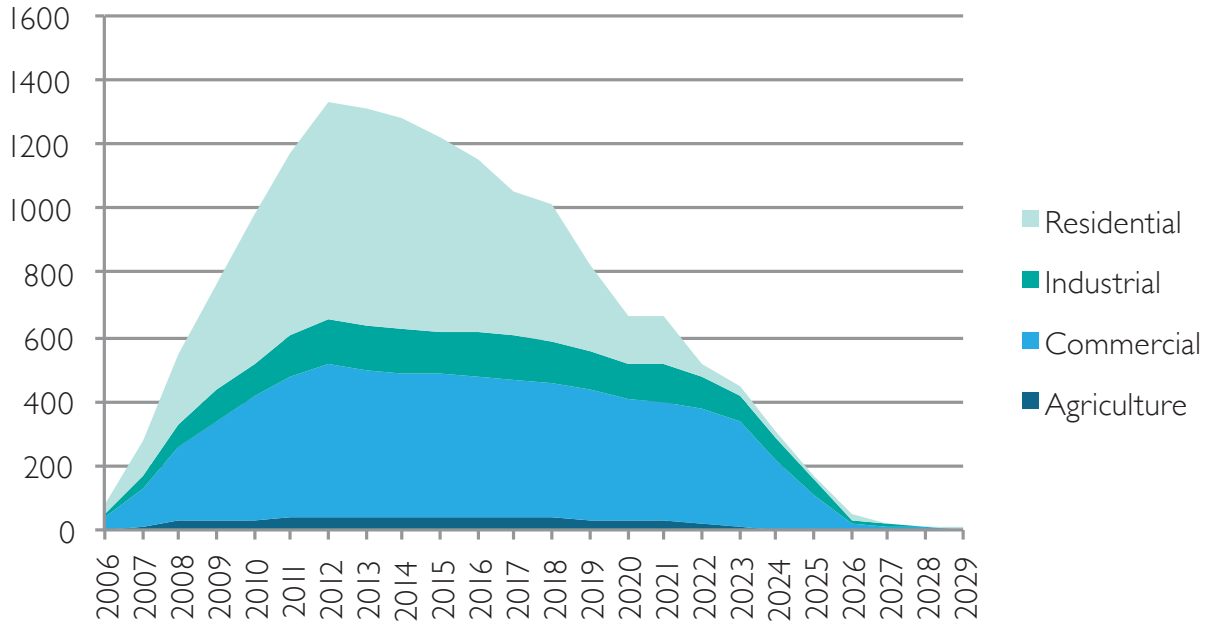


Figure F-4 PG&E Lifecycle Savings (Therms) by Sector, 2006-2012



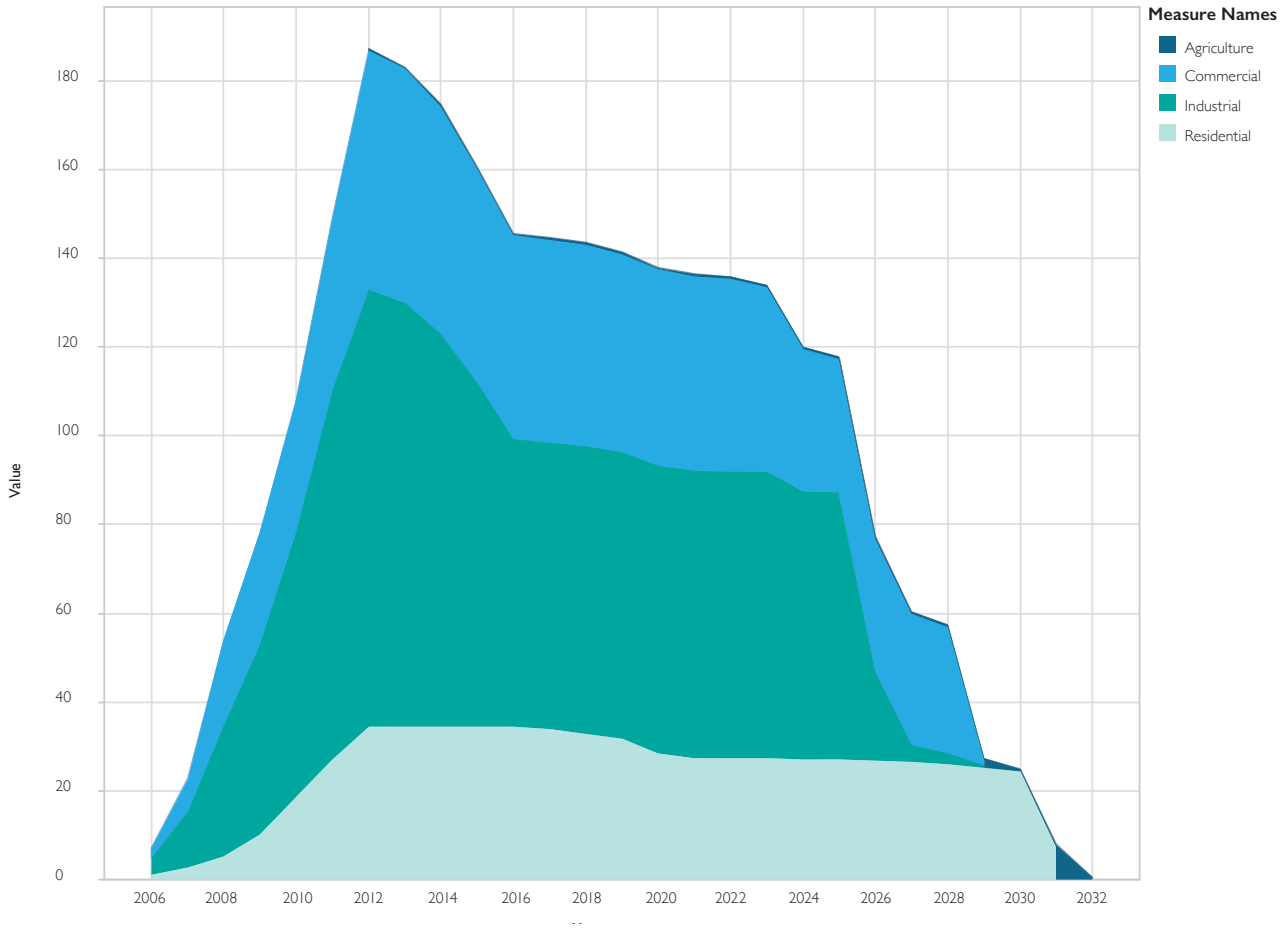
SCE

Figure F-5 SCE Lifecycle Savings (GWh) by Sector, 2006-2012



SoCalGas

Figure F-6 SoCalGas Lifecycle Savings (MMTherms) by Sector, 2006-2012



SDG&E

Figure F-7 SDG&E Lifecycle Savings (GWh) by Sector, 2006-2012

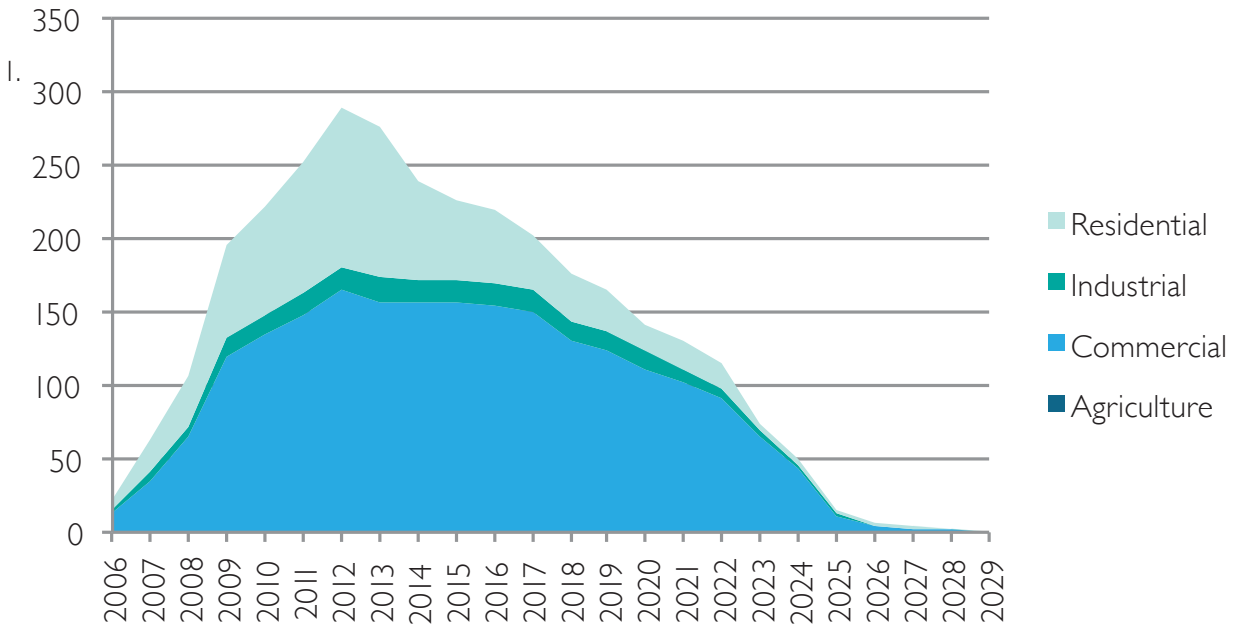
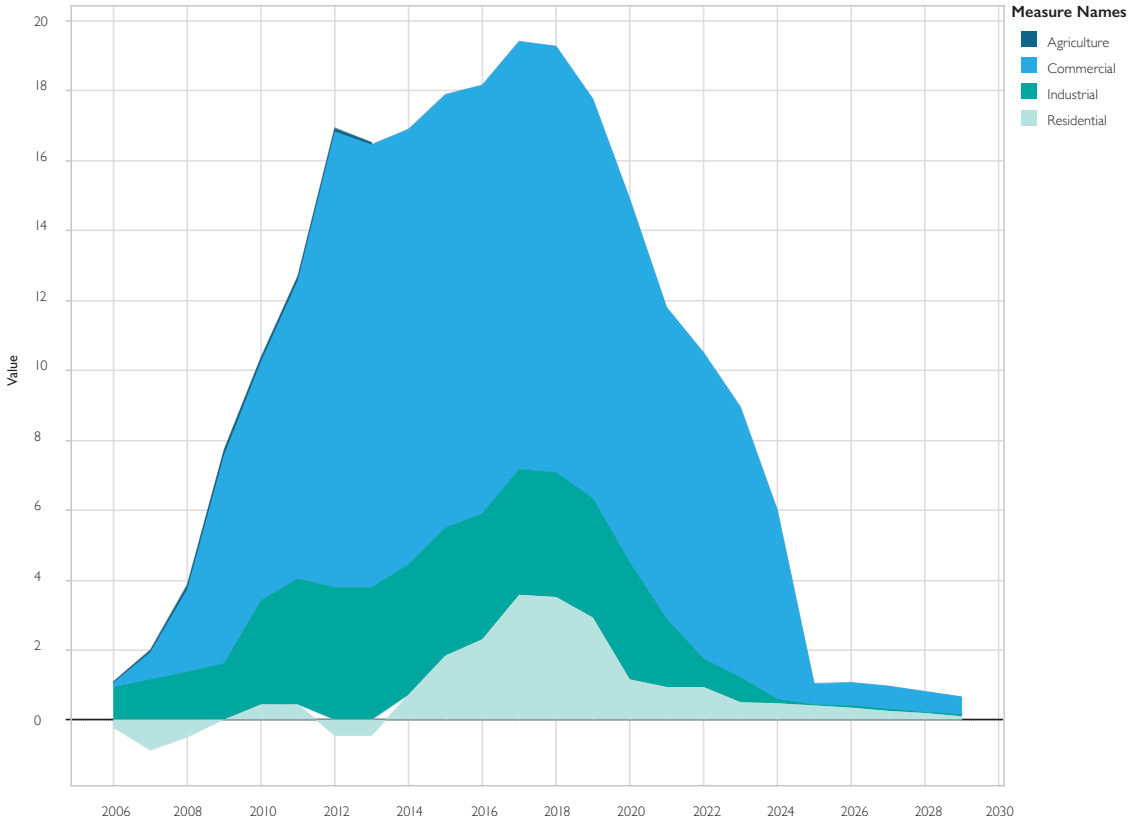


Figure F-8 SDG&E Lifecycle Savings (Therms) by Sector, 2006-2012



Appendix G: Processing and Updating Utility Claim Data with Evaluation Results Data

The utility energy efficiency program tracking data forms the basis for critical program reporting functions and for evaluation sampling and execution. Over the course of the 2010-2012 program cycle, the Commission and the utilities housed all applicable, claimed values in a set of relational tables that were referenced by quarterly utility claims. This data set is the foundation for the values in this report, and it was compared and reconciled with publicly available monthly and annual reports from the utilities.

By the end of the 2010-2012 program cycle,, the IOUs submitted consistent and uniform quarterly claims along with corresponding ex-ante data tables. The ex-ante and claim data were consistent and uniform across all IOUs. This consistency significantly reduced data cleaning and processing time to compile the data needed to calculate cost effectiveness and produce Commission reports and enabled the development of the Energy Efficiency Statistics Data Portal. The steps for cleaning and processing the IOU submitted data are described in this appendix.

Preparation of IOU Quarterly Tracking Data for Reporting

Each quarter, the following steps are performed to process IOU reported data for the Energy Division, it is followed by an illustration of the process.

IOU Claim Submissions (CPUC)

1. Receive FTP link to download data from IOUs
2. Bring IOU data submissions onto ED Central Server (EDCS) and into SQL Server database
3. Write IOU data together into standardized tables
4. Join claim tables to the ex ante database for deemed claims; write data into "EDFilled" table
5. Quality check the data submission

Evaluation Results Submissions (CPUC)

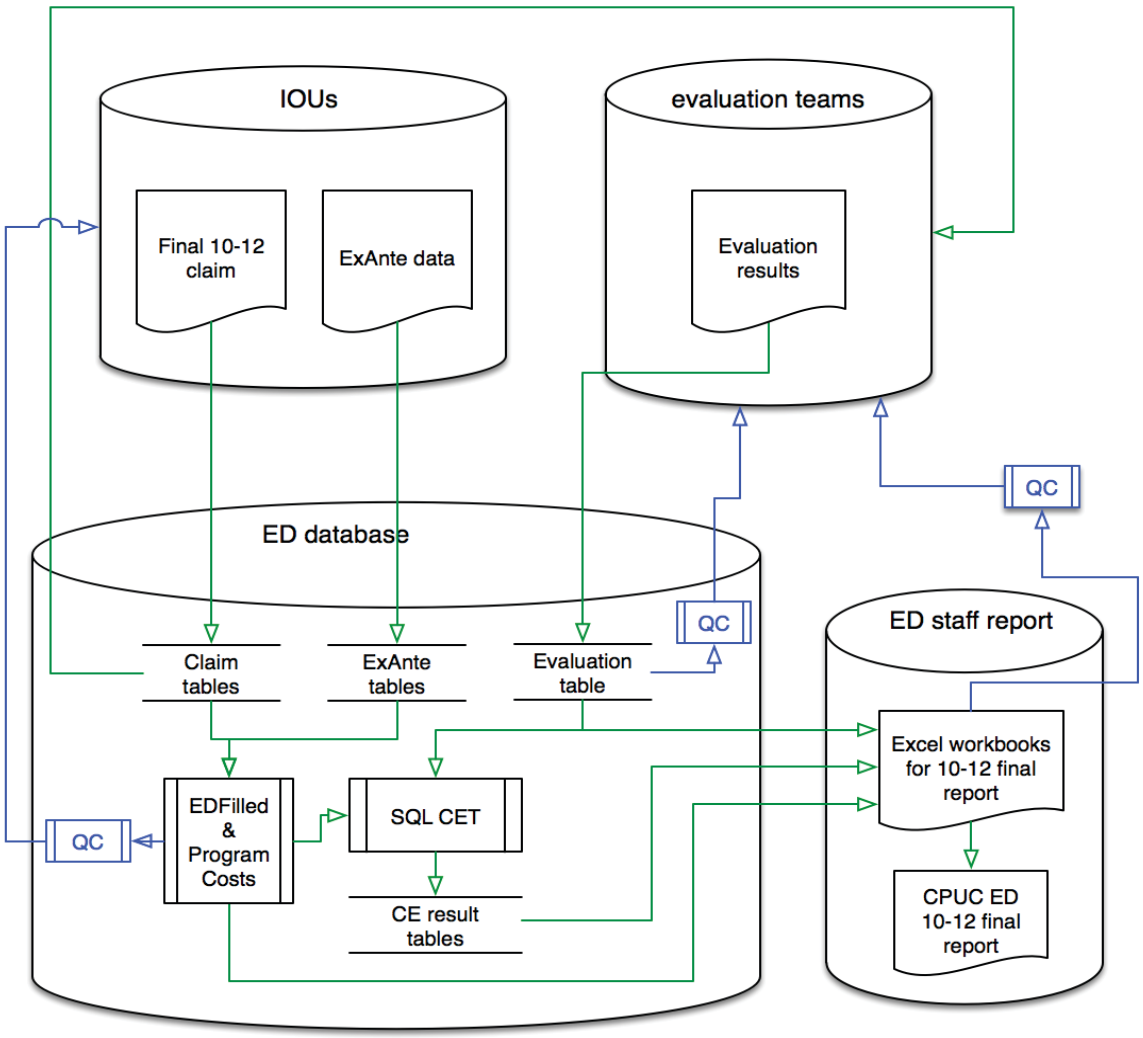
1. Evaluation team posts data submission file to EDCS
2. Bring evaluation data into SQL Server database
3. Write evaluation data together into the Evaluation table
4. Quality check the data submission

Cost Effectiveness Run (CPUC)

1. Run EDFilled and Evaluation tables through the Cost Effectiveness Tool (CET)
2. Write CET results into SQL Server database
3. Validate and quality check CET results against SQL savings calculations and monthly reports Report Preparation (CPUC)

Final step. Summarize data to produce result sets for Energy Division staff to use in evaluated program cycle reporting.

Figure G-1 Claims Processing



Data Cleaning

Although the IOU claims improved considerably from the 2006-2008 cycle, the central data set still required some level of data cleaning to enable processing through the cost effectiveness tool. Data elements such as Target Sector, Climate Zone, Costs, and other parameters necessary for evaluation and cost effectiveness calculations were cleaned by the CPUC evaluation contractors in conjunction with IOU staff. Throughout the cycle, the amount of data cleaning necessary was continuously reduced as IOUs improved their reporting capabilities. The result of the data cleaning process was a table named "EDFilled," which contains all cleaned ex-ante IOU data necessary to run through the CET.

Validation and Quality Control

The main component of the Energy Division's data cleaning process were several quality control algorithms that were developed early in the 10-12 cycle and refined and enhanced throughout the cycle. All quality control algorithms were communicated to the IOUs via the 2010-2012 Data Transfer Tool, an Access file that the IOUs could use to transfer their quarterly tracking data to the ED and QC their own data before transferring. The link to this tool on EEStats is: http://eestats.cpuc.ca.gov/EEGA2010Files/GuidanceDocuments/Q12_Data_Transfer_Tool_May_Update.accdb

The end product was a clean, consistent data set of claims which were ready for evaluation sampling and update.

Appendix H: Evaluation Decision Framework

Commission staff utilized the detailed quarterly data, described in the prior appendix, as the foundation for prioritizing evaluation activities the point of comparison for applying updates from new information gathered from field evaluation.

Commission staff was directed to address eight specific parameters in their original evaluation mandate. In authorizing the evaluations of the 2010-2012 program cycle (D. 09-09-047) the responsibility for planning and conducting the impact evaluations was maintained with Commission Staff. The additional framework of collaboration laid out in D. 10-04-09 resulted in a joint evaluation plan being developed by the Commission and utility EM&V staff. This joint plan and the detailed evaluation plans illustrated Commission staff's plans to make updates to the claims on a parameter basis in addition to meeting other evaluation objectives.

Eight specific parameters were identified by the Commission and basic direction for updating those parameters. These include:

Parameter (* Means updated)	***Nature of Update in 2010-2012***
**Measure Installation*	*Independent "verification" studies were not conducted, but through the course of the impact evaluations, information was available to update the installation rate information for about half of the utility claims*
Program Costs	*The CPUC conducts regular audits and these reports may result in changes for the allowable costs. The costs at the measure-level were not updated. However the costs for the Energy Savings Performance Incentive as well as an error in costs. The correction is presented in the Cost Effectiveness Results appendix.*
**Unit Energy Savings /Savings by Program Strategy*	*The primary focus of the 2010-2012 evaluations was of the gross and net energy savings. 70% of the kWh, kW and therm savings were subject to some form of field evaluation.*
**Program level estimates of gross and net Savings*	*Roughly 70% of the kWh, kW and therm savings had a net to gross update based on field evaluation.*
**Load Factors or Daily Load Shapes for Peak Savings Estimates*	*Peak demand evaluations were part of the full impact evaluation. 70% of reported kW savings were updated.* *The peak savings estimates were evaluated in accordance with the Gross Demand Impact Protocols and consistent with the definition of peak demand adopted in D.06-06-063 (and compared to DEER 2008 Table 2. Peak Demand Period Used for DEER 2008 for each climate zone).*
Incremental Measure Costs	*The evaluations of the 2010-2012 program cycle did include an Incremental Measure Cost study; and results will likely be added to DEER estimates of incremental cost. No updates to incremental measure cost were made to the claims, but the cost effectiveness calculation was corrected for an error in which rebates were greater than incremental measure costs.*
Avoided Costs	*Avoided costs in the filed cost effectiveness calculators have been reviewed for consistency with the avoided cost proceeding and have not been modified in the final evaluation results contained in this report.*
**Expected Useful Lives of Measures*	*Information from downstream lighting activities affecting the EUL and RUL (Remaining Useful Life) dual baseline considerations were updated base on the evaluation for about 20% of the claims.*

Commission staff and evaluation contractors utilized the following options in making updates to the utility savings claims for the aforementioned parameters:

1. Pass through: Accept reported savings values for claims that do not fall within the frame of an impact evaluation (no change);
2. Leverage results from an evaluation study: Apply stratum-level results to records included in the frame of an impact evaluation. These data are considered "evaluated results" and are used in the context of this report;
3. Leverage results of ex-ante data review: Validate that DEER and non-DEER workpapers properly apply approved values, and then pass through.

Evaluation Decision Framework

The decision tree in the following figure illustrates how IOU claims were updated with field evaluation results for the 2010-2012 program cycle. This applies to all parameter updates listed above. Specific updates within unit energy savings and program performance include net to gross ratios and realization rates. The specific values that were used for the updates are described later in the appendix.

Figure H-1 Evaluation Framework Decision Tree

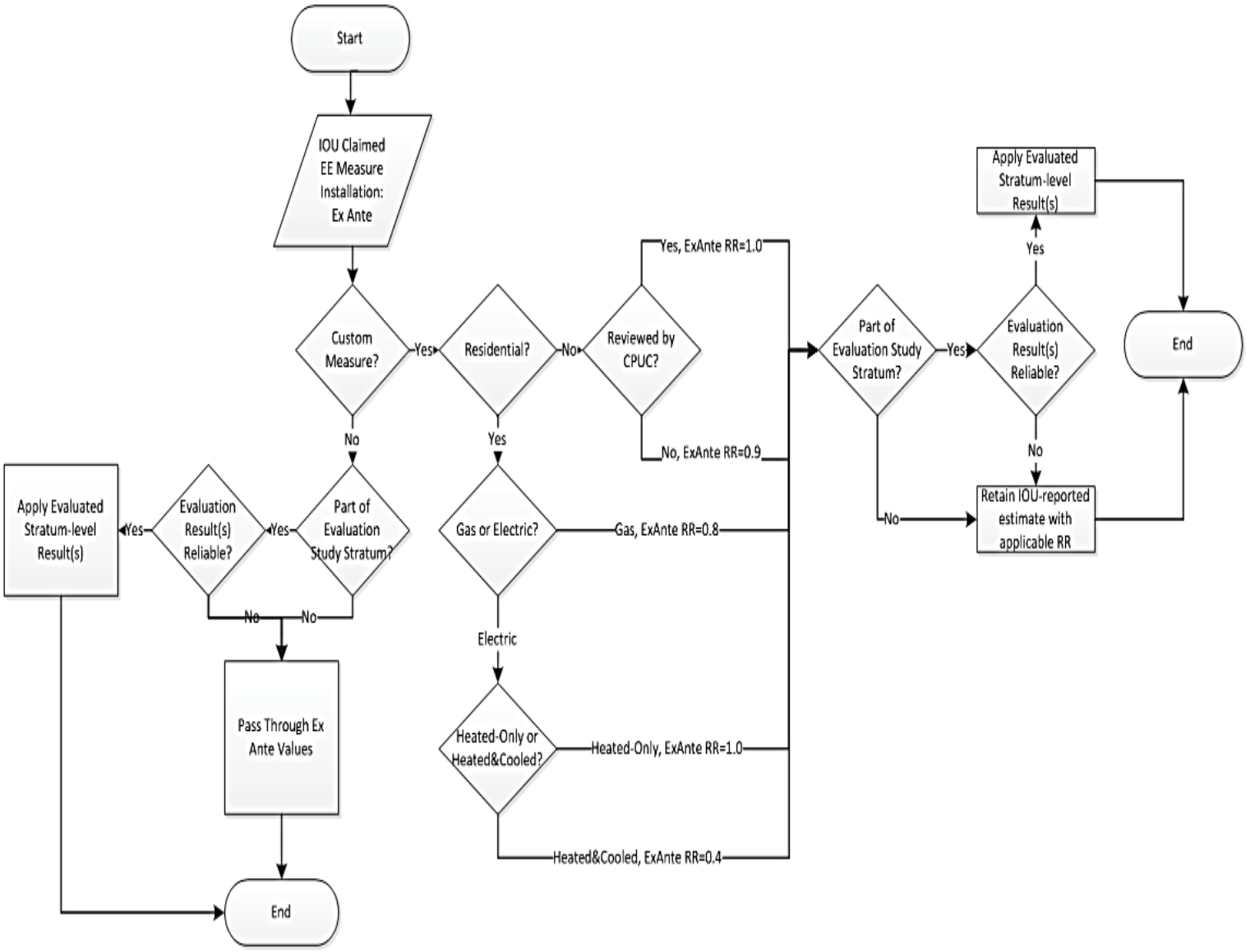


Figure H-2 Percentage of Portfolio kWh Parameter Updates by IOU

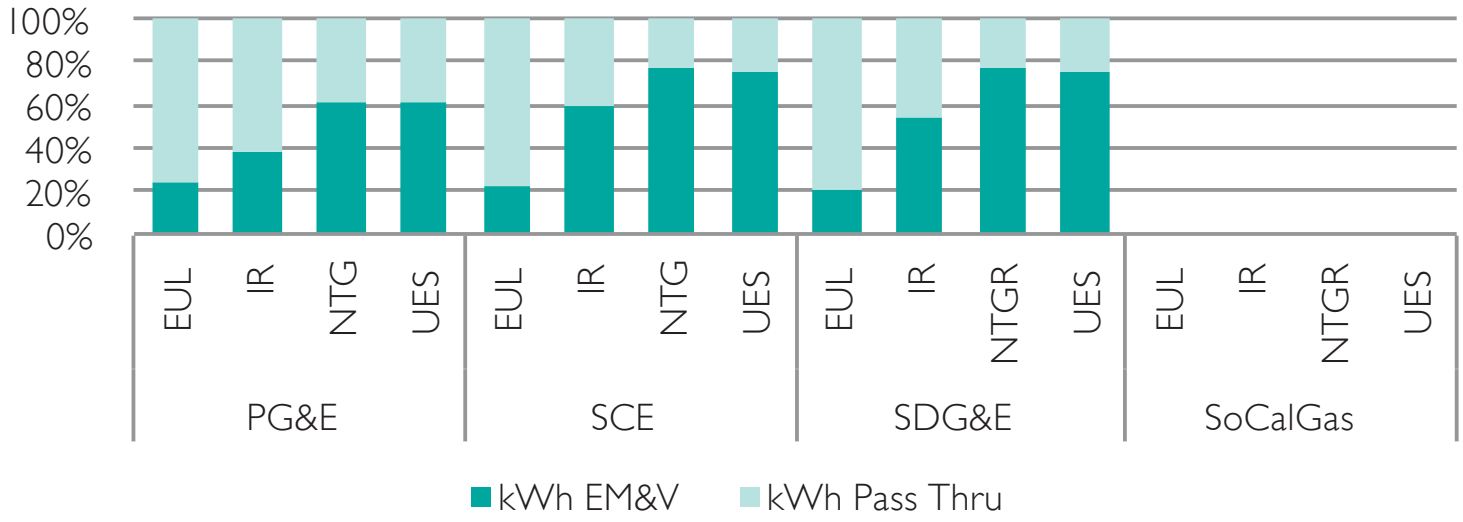


Figure H-3 Percentage of Portfolio kW Updates by IOU

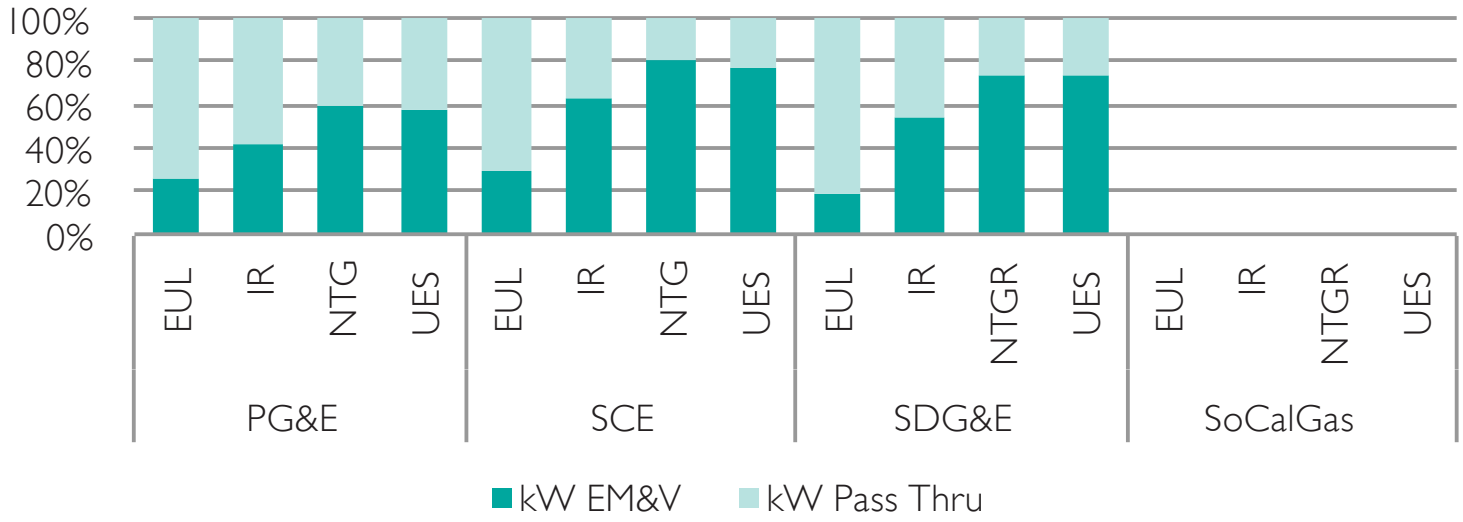
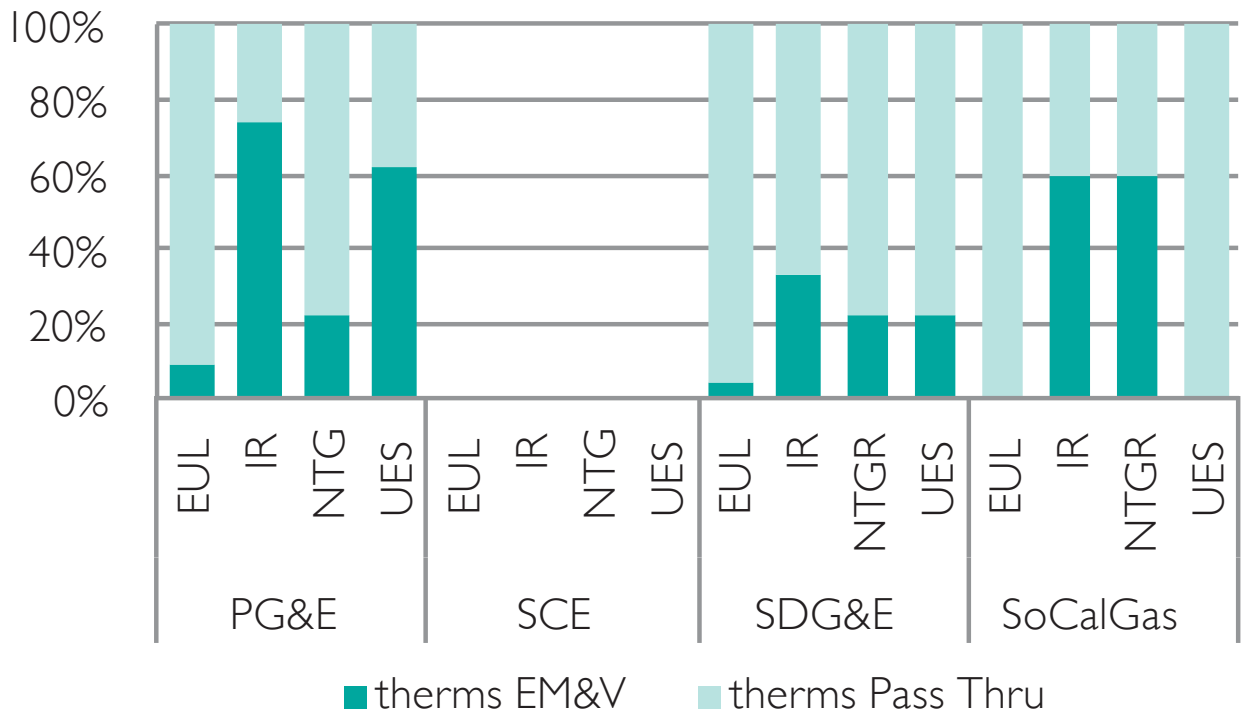
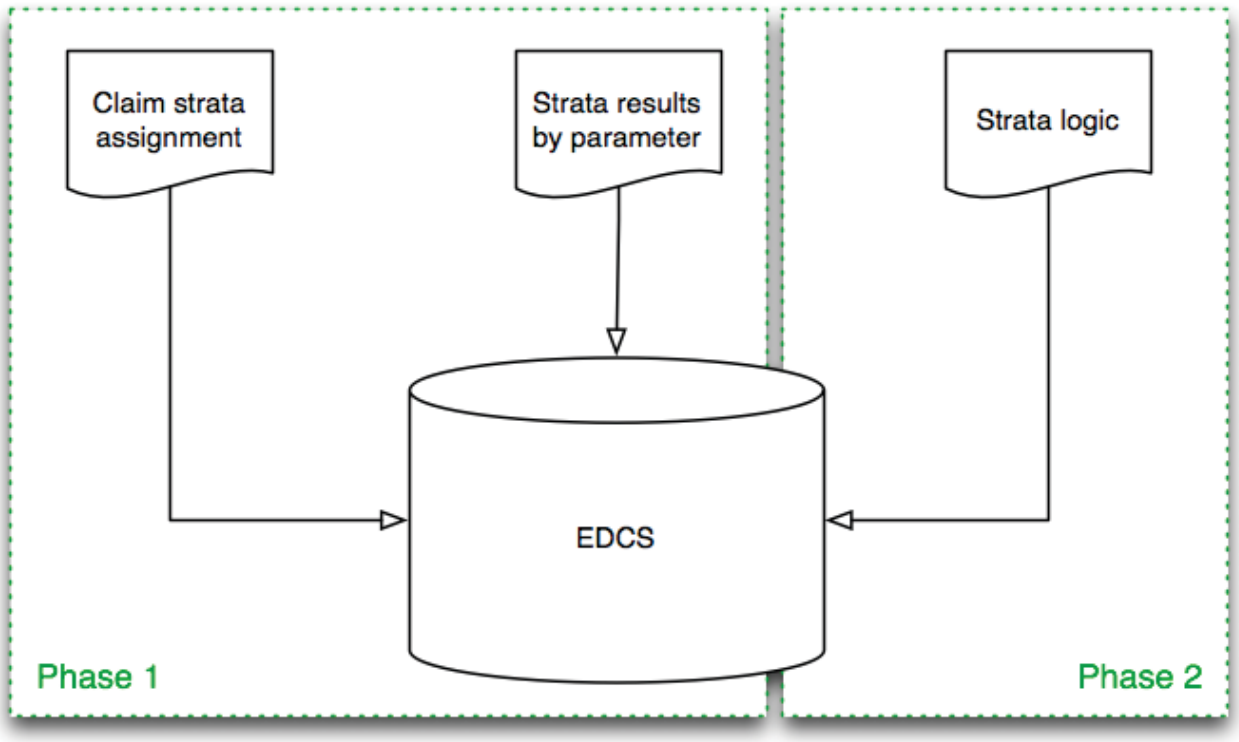


Figure H-4 Percentage of Portfolio Therm Updates by IOU



Evaluation reports were submitted by the two evaluation teams, DNV-GL and Itron. Eight evaluations submitted impact results for the 10-12 program cycle. Each final evaluation report was reviewed and vetted via the public review process and the final numbers were provided to the data processing team. Evaluation impact results are summarized, then downloaded and processed into the SQL Server database on the Energy Division Central Server (EDCS), an internal server (not publicly available) used to manage the data in a secure environment. Evaluation results are reported in two phases: the first phase is to deliver the data required to apply evaluation results to the final 10-12 claim. In the second phase the evaluation contractors provided the logic assign 10-12 claims into strata. A visual of this process is provided in the following figure.

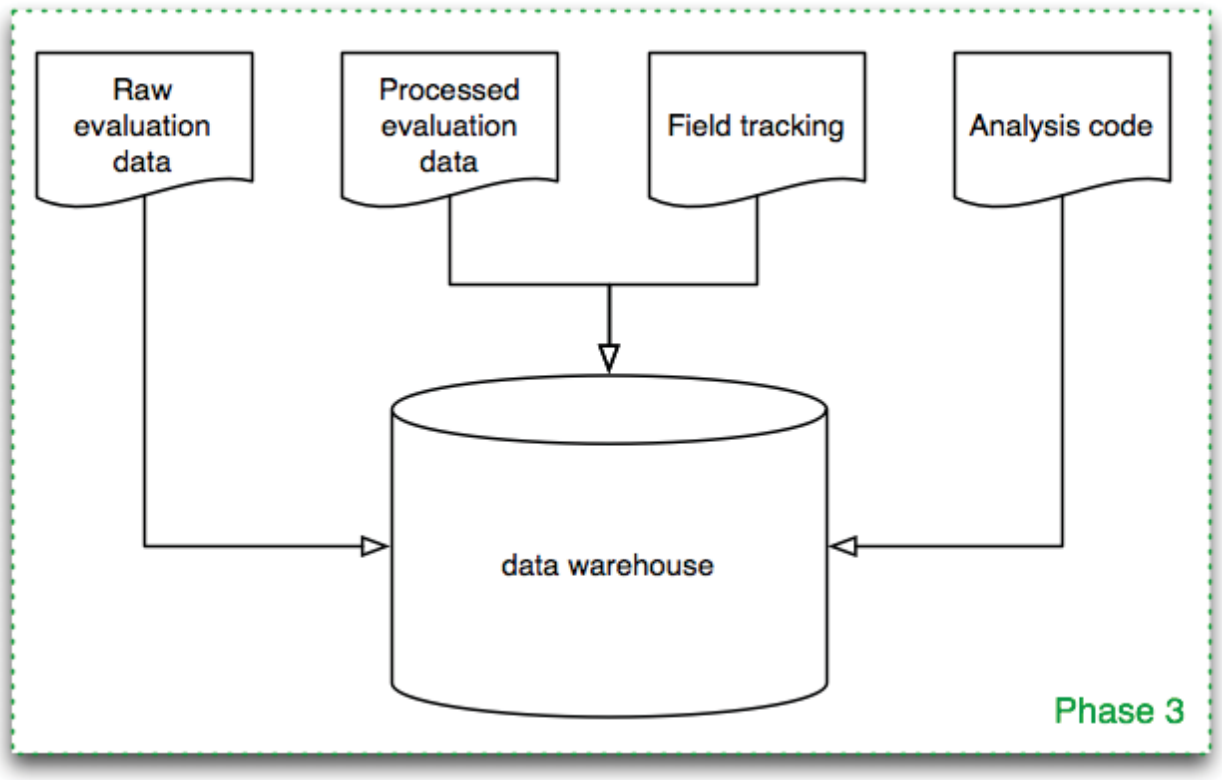
Figure H-5 Reporting of Evaluation Results:
Phase 1 and Phase 2



Following phases one and two is the third and final phase of evaluation data reporting. Phase three covers submission of all raw and processed evaluation data, analysis and processing code, and field tracking data to the online Energy Division data library.

The data library is maintained by Energy Division for future reference for evaluation activities and for savings estimation analysis (i.e. ex ante values for work papers or DEER updates).

Figure H-6 Reporting of Evaluation Results: Phase 3



Phase 1 Data Specification

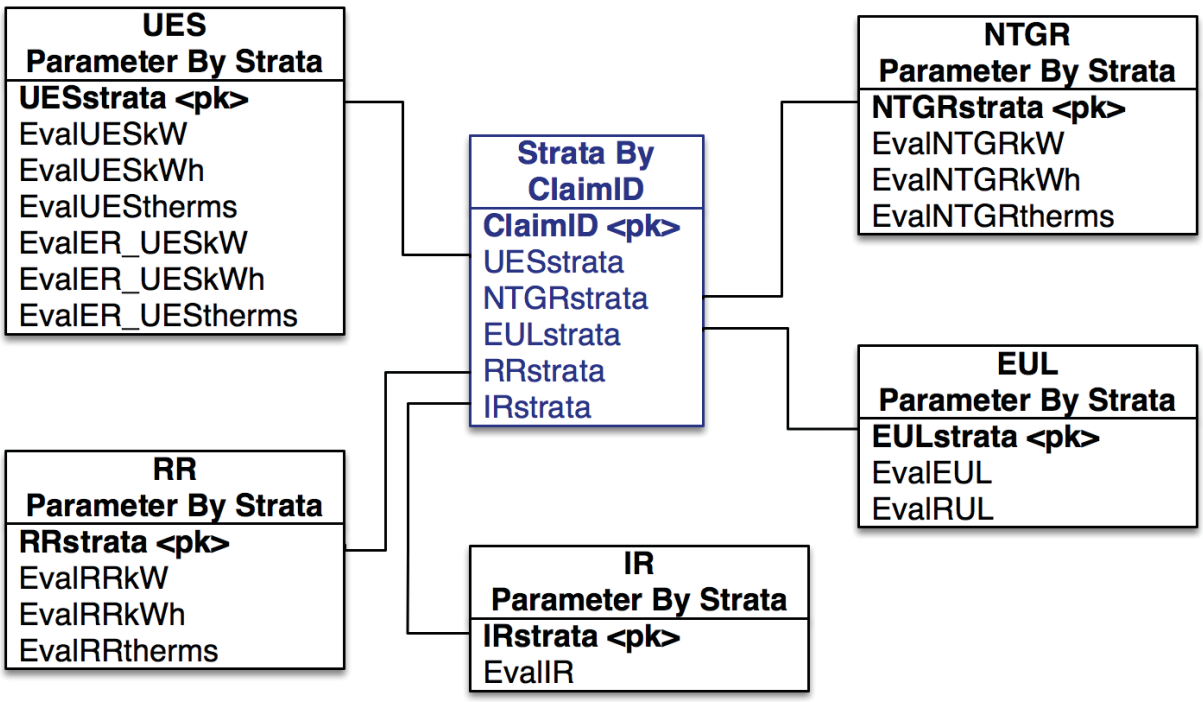
The data specification for evaluation results submitted by evaluation contractors consists of two primary components: record assignments to strata (the blue table in the middle of the following figure), and evaluation parameter results by strata (the five other black tables of the following figure). The two components are linked to assign evaluation parameter results to claim records in a transparent relationship. The connection and resulting data is designed to be consistent with the field evaluation sample structure.

Two phase 1 data elements

1. Parameter by Strata (PbS) - evaluation parameter results for each strata
2. Strata by ClaimID (SbC) - assignment of claim lines to strata

These two data elements are brought together to assign evaluation results to the claim data.

Figure H-7 Evaluation Phase I Data Specification



Data Specification Files

The Parameter by Strata (PbS) database provides the Strata by ClaimID template for reporting strata assignments for each claim record. It also includes QC tables that are used to check the application of the data to the claim.

ParameterByStrata.accdb databases (residential and commercial) are available on the EEStats website: http://eestats.cpuc.ca.gov/Views/AnnualReport/AnnualReport.aspx?ContentId=15

Summary of Results by Work Order and Updated Parameter

The following tables summarize the study results from each evaluation group, broken out by updated parameters. The included Excel file for Appendix H shows the evaluation-updated savings parameters for the work orders (WO) in Table H-1:

Table H-1 List Impact Evaluations in 2010-2012

Project	Evaluation Title	Contractor
WO 28	Residential Advanced Upstream Lighting Impact Evaluation	KEMA/DNV-GL
WO 29	Downstream Lighting	Itron
WO 32	HVAC	KEMA/DNV-GL
WO 33	Custom Impact Evaluation	Itron
WO 34	Consumer Electronic Plug Load Impact Evaluation	KEMA/DNV-GL
WO 35	Appliance Recycling Program	KEMA/DNV-GL
WO 36	Energy Audit and Survey Impact Evaluation	Itron
WO 46	Whole House	KEMA/DNV-GL

Table H-2 below shows the high level breakdown of the claimed savings which received an evaluation update based on the data available from the evaluation contractors and in relationship to the claims from the utilities. The percent of the evaluation claim which has had a specific update statewide and for each utility is provided in this Appendix.

Table H-2 Percent of Reported Savings Updated with Evaluation Results by Evaluation Parameter

Parameter	GWh Evaluated	% Portfolio Evaluated	MW Evaluated	% Portfolio Evaluated	MMTherms Evaluated	% Portfolio Evaluated
UES	4,386	89%	804	95%	71	76%
NTG	4,465	91%	835	99%	71	76%
IR	3,157	64%	620	73%	17	18%
EUL	1,500	30%	326	39%	5	5%

Appendix I: SQL Cost Effectiveness Tool Documentation

For this report, a SQL based cost effectiveness tool was developed to improve the efficiency of the portfolio level analysis and cost effectiveness calculations. Cost effectiveness is calculated using the reported claim data and can be run on incremental or full application of evaluated parameters or "scenarios" using the SQL-based cost effectiveness tool (CET). The CET calculates cost effectiveness on the portfolio and programs using methodologies adopted in the California Standard Practice Manual – Economic Analysis of Demand-Side Programs and Projects.[1] Cost effectiveness is calculated using lifecycle cost-benefit ratios as described in the appendix titled "Cost Effectiveness Results". Common tests are the total resource cost (TRC) and program administrator cost (PAC) ratios. These ratios are based on the net present value of benefits, determined by avoided cost methodology[2], divided by net present value of costs. The CET employs the same equations that are in the E3 Calculator[3] and documented in the E3 Calculator TechMemo.[4] The E3 calculator is used to verify the results of the CET to ensure consistency with the commonly used tool for program administrators and other stakeholders.

What is the CET?

The CET consists of stored procedures (code), views (queries), and tables in a relational SQL Server database environment which enable cost effectiveness calculations to be run efficiently on the 6,220,353 reported claim records in the 2010-12 statewide portfolio. Cost effectiveness can be calculated at the measure, program, IOU portfolio, and statewide portfolio levels. Because benefits and costs are generated at the measure level, it is possible to derive cost effectiveness for any grouping of measures in the portfolio, for example any particular end use, target sector, or building type. The complete documentation of the CET can be found in the 2010-12 SQL CET Documentation[5] memo. A fully functional CET_1012_AnnualReport_Review database, including claim records and evaluation results can be downloaded from Appendix L on the EEStats website http://eestats.cpuc.ca.gov/Views/AnnualReport/AnnualReport.aspx?ContentId=15 . Note that in order to use this database SQL Server must be installed on the user's computer.[6]

1 Available at http://www.cpuc.ca.gov/NR/rdonlyres/004ABF9D-027C-4BE1-9AE1-CE56ADF8DADC/0/CPUC_STANDARD_PRACTICE_MANUAL.pdf

2 Available at: https://ethree.com/public_projects/cpuc5.php

3 Available at https://ethree.com/public_projects/cpuc4.php

4 Available at https://ethree.com/documents/E3_Calculator_TechMemo_6d.docx

5 Available at: http://eestats.cpuc.ca.gov/EEGA2010Files/GuidanceDocuments/SQL%20CET%20Review%20Documentation_v3.zip

6 A free version of SQL Server 2014 Express can be found here: http://www.microsoft.com/en-us/server-cloud/products/sql-server-editions/sql-server-express.aspx

Appendix J: Relative Influence of Evaluation Updates with Scenario Analysis

The application of each type of evaluation parameter update to the original claimed savings allows for the analysis of the incremental effect of each parameter. This is useful in the context of understanding what elements of the evaluation findings may have been within the control of the implementer versus general market conditions, or which savings are realistically available to the grid versus those which did not likely happen at all.

Commission staff has built into the data tools a functionality called "scenarios". These represent the different conditions of toggling on and off different parameter updates. They are used in this report to adjust assumptions regarding savings and evaluation parameters and to illustrate the relative impacts of these parameters on savings as well as cost effectiveness. The cost effectiveness tool (CET) repeats calculations using specific evaluated parameters as adjusted inputs, depending on the scenario, to calculate measure, program, and portfolio-level cost effectiveness. The full evaluation scenario includes input adjustments for all evaluated parameters and is the basis for the CPUC's final portfolio evaluation results.

The high-level scenario matrix below gives an overview of the evaluation parameters adjusted for each scenario. An 'X' indicates that, when available, a specific evaluation parameter-level result is used as an input to the CET for a specific scenario. If a parameter is not evaluated for a particular claim, then the value is "passed-through" from the reported claim record. Similarly, if a claim record is not evaluated, then the claim values will be passed-through from the unevaluated claim. The detailed decision map, the proportion of claims updated is provided in the appendix titled "Evaluation Decision Framework".

Table J-1 High-Level Scenario Matrix

Scenario	NTGR	UES	RUL	EUL	IR	RR	Qty
Reported[1]							
EvalFull	✓	✓	✓	✓	✓	✓	✓
EvalFullGross	I	✓	✓	✓	✓	✓	✓
EvalGross	I						
EvalNet	✓						
EvalUES		✓					
EvalEUL			✓	✓			
EvalIR					✓		
EvalRR						✓	
EvalQty							✓
EvalNoUpdate							

[1] *All scenarios are single fuel with the exception of Reported which is duel fuel. All scenarios "zero-out" electrical savings for SCG and gas savings for SCE.*

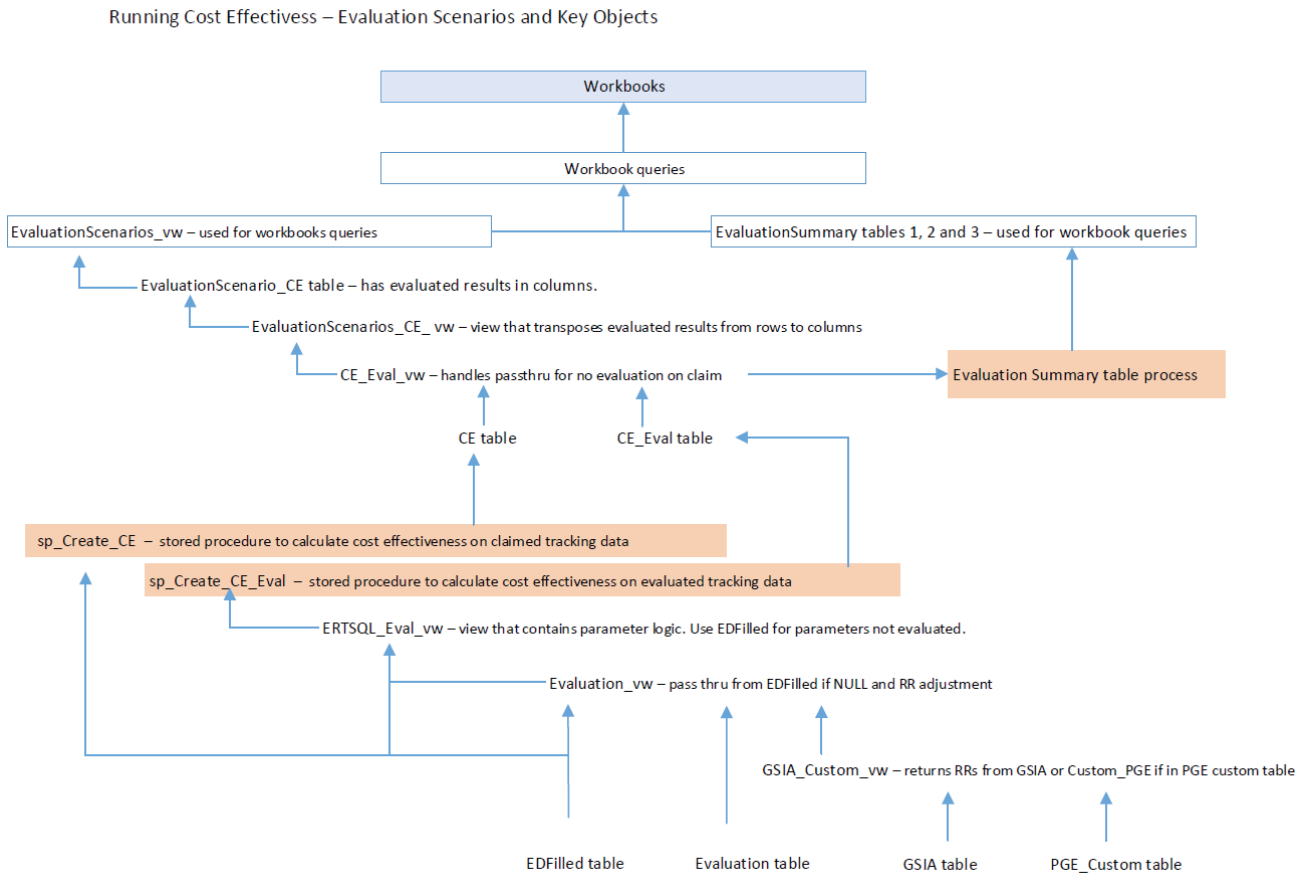
Running Evaluation Scenarios and Key Objects

The following flowchart illustrates how reported (unevaluated) and evaluated data flows through the cost effectiveness process. The CET pulls the various data parameters (claimed and evaluated) to run cost effectiveness and savings summaries on each scenario to produce data for summary workbooks by sector, appendices, and graphics displayed in the Energy Efficiency Statistics page in the Energy Efficiency Data Portal [http://eestats.cpuc.ca.gov/Views/EEDataPortal.aspx].

Source Data are the EDFILLED and Evaluation tables, both of which are found in the Data Appendix. The process of creating EDFILLED is described here. The process of creating the Evaluation table is found here.

The outputs from the scenarios are available to users when downloading the full set of 2010-2012 tools described in these appendices including the Cost Effectiveness Tool and the CET_1012_AnnualReport_Review database. The incremental outputs from this tools were the foundation for developing an portfolio level summary of the relative influence of each evaluation update.

Figure J-1 Running Cost Effectiveness, Data Flow



Scenario outputs and relative influence of parameter updates

The following graphics provide an illustration of the relative influence of each parameter update. Several caveats are necessary to appreciate the limitations and value of these graphics, and in fact their calculation is pathway-dependent. First, more than one parameter update may have been applied to a measure (e.g. unit energy savings and installation rate were updated for an installed light bulb). Hence the influence of each parameter cannot be completely isolated but they interact. Second, the parameter may have multiple factors within its calculation that could influence the value (e.g. hours of use within the unit energy savings) and this break down is at the highest parameter level. Third, the parameter gauging program influence (the net to gross ratio) is estimated in the program plans, and in many cases updated with evaluated results. The graphics show the program attribution in its two constituent parts to illustrate that the additional net adjustments from evaluation were small relative to the already assumed net adjustment.

The following parameter adjustments in the graphics are defined as follows:

a.) Installation Rate – the units were verified as installed and operating
b.) Unit Energy Savings Adjustment – savings per unit installed (for deemed measures)
c.) Realization Rate – savings achieved versus expected (ratio used for custom projects)
d.) Program influence Expected Adjustment (reported) – planning assumption of program influence
e.) Program influence Evaluation Adjustment – incremental difference in program influence found through field evaluation.

The statewide and utility specific results are provided in the following series of graphics. The net adjustments are the largest for all three utilities and statewide for electric savings (about half). Gross adjustments made up the other half with the relative influence being attributable mostly to the unit energy savings (25 percent) adjustment and equally, but in different directions, the installation rate (upward 11 percent) and realization rate (downward 11 percent). Hence the influence of the programs was not drastically different from portfolio planning expectations, and the adjustments for gross savings estimates were a function of new information regarding performance and assumptions that was gathered in the field data collection.

Figure J-2 Statewide Relative Parameter Influence – GWh

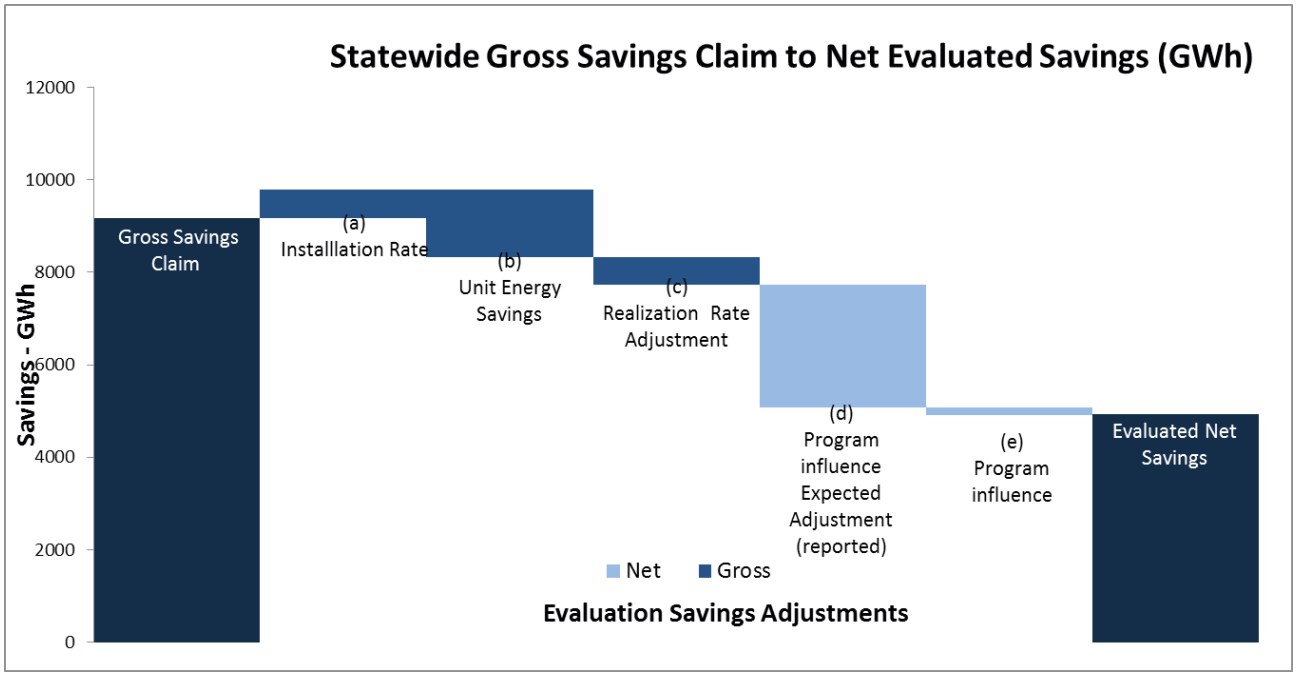


Figure J-2 PG&E Relative Parameter Influence – GWh

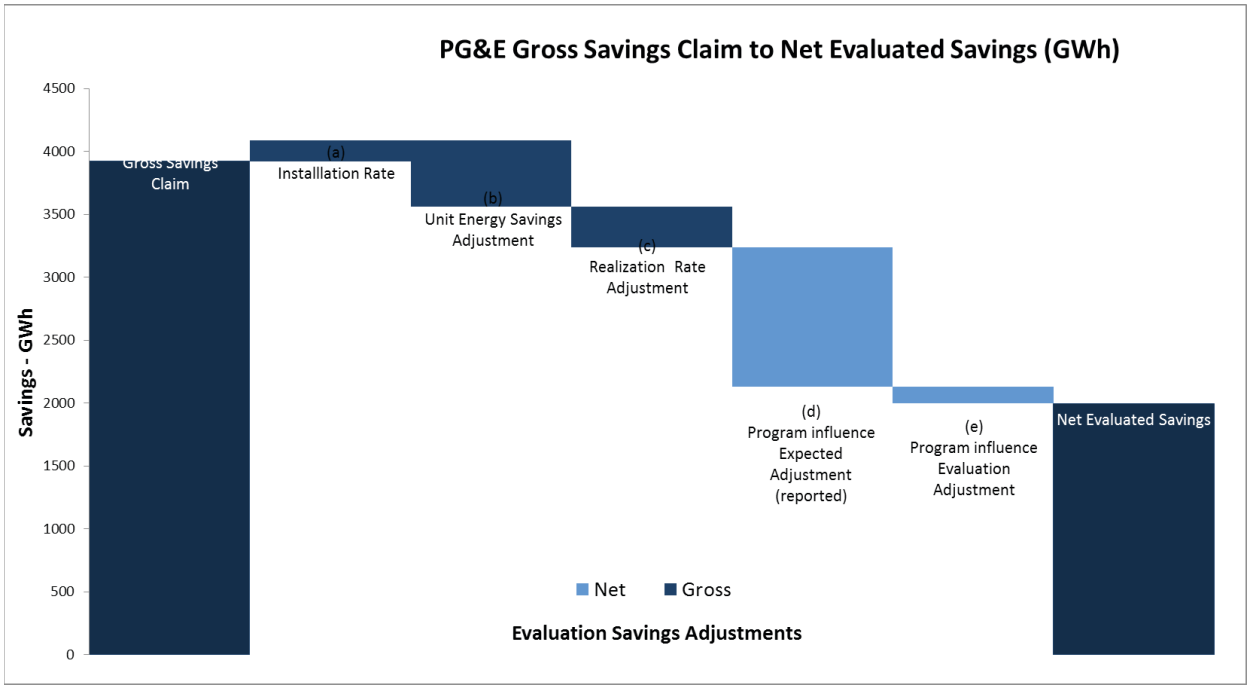


Figure J-3 SCE Relative Parameter Influence – GWh

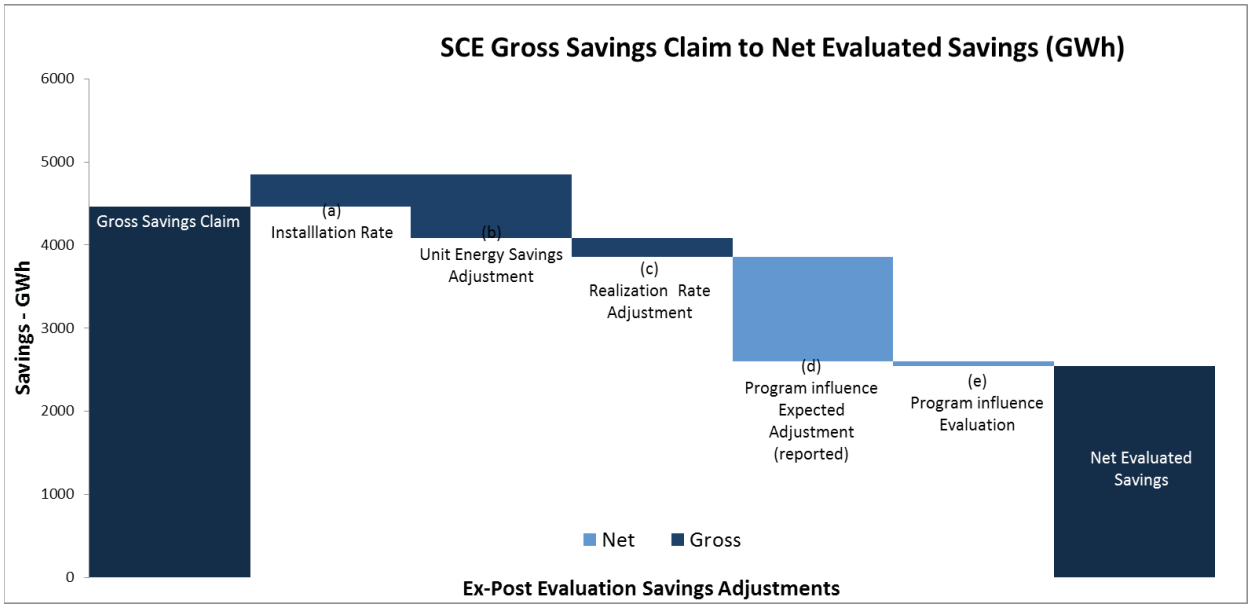
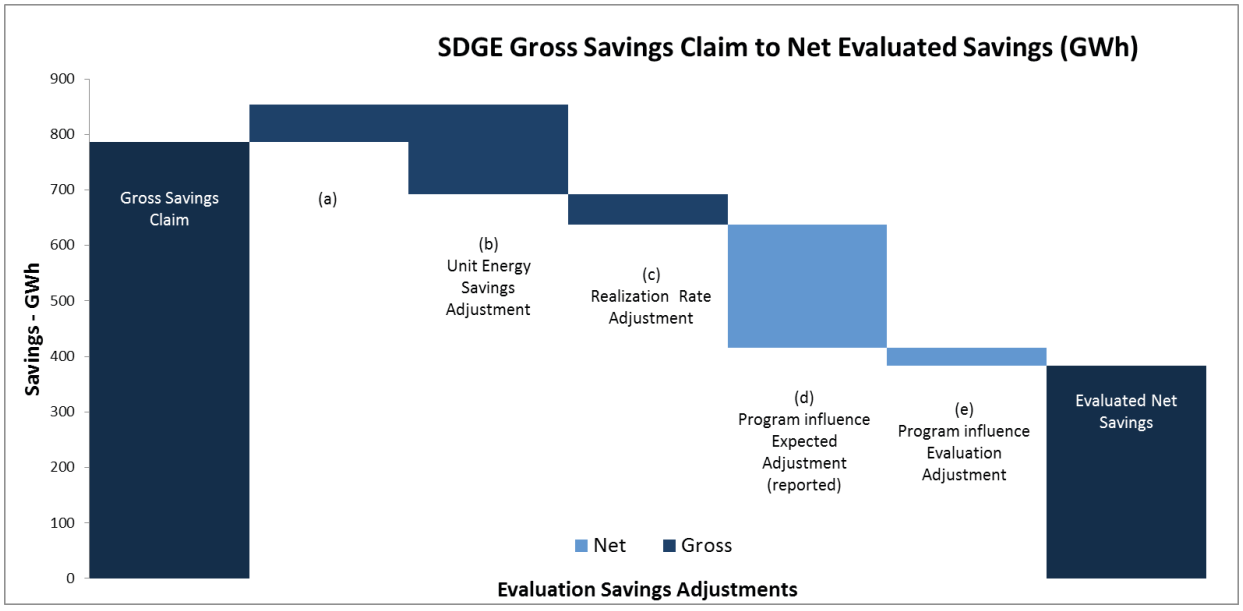


Figure J-4 SDG&E Relative Parameter Influence – GWh



Appendix K: Carry-Over of Stored Bulbs and Bulb Flow Transition

The following outlines the change in method used by Commission Staff to calculate and credit stored bulbs in 2010-2012 and the resulting distribution of 2010-2012 CFL savings credit between the 2010-2012 and 2013-2014 portfolios.

Because light bulbs are often bought by customers in bulk and stored for later use, beginning with the 2006-2008 portfolio and continuing with the 2009 bridge year, a portion of program bulbs were credited forward to reflect how this resource appears as "installed and operating" as a grid resource .

In light of the complexities associated with modeling and tracking the vintage of and savings credit for stored lamps (an exercise that relies on assumptions about program market share and burnout/early replacement rates that is not grounded in reliable data), as well as the relatively short storage period observed in the field for stored bulbs, the 2010-2012 impact study evaluators have recommended a transition in accounting to credit program CFL bulb savings in the year in which the bulbs are sold. This approach would eliminate the need to carry over savings from one program year or cycle into subsequent programs and would also allow each program year and cycle to be evaluated independently.

Commission staff has adopted this proposal. However, given the fact that the utilities had managed their 2010-2012 and 2013-2014 portfolios under the assumption that stored bulb savings would be carried into subsequent portfolios, staff has provided the utilities with some flexibility for applying a portion of the 2010-2012 upstream CFL savings that would have been carried over into the 2013-2014 portfolio to their 2010-2012 or 2013-2014 savings goals. This is of particular concern for the two combined electric and gas utilities, since CFL energy savings create negative therm savings through interactive effects that can adversely impact their total therm savings.

This appendix describes the transition path proposed by staff including the rationale behind its design and the amount of savings that would have been carried over until 2013-2014 under the previous approach that are now being credited to the 2010-2012 and 2013-2014 portfolios, based on each utility's "stored bulb savings transition election."

Magnitude of Stored Bulbs

Table K-1 uses the spreadsheet posted to the Public Documents Area with the final WO 28 California Upstream and Residential Lighting Impact Evaluation Report to calculate the amount of kWh, kW, and therms savings come from stored bulbs being credited in 2010-2012 that in the previous accounting approach would have been carried over and credited in subsequent years were developed using Column H represents the amount of bulbs that are being credited in 2010-2012.

Table K-1 - Magnitude of Stored Bulbs

2010-2012 Upstream Lighting Impact Report	Ex ante IR	Ex Post IR	Sum of Qty	Sum of Combined evaluated Gross kWh Interactive Effects	Sum of Combined evaluated Gross kW Interactive Effects	Sum of Combined evaluated Gross therm Interactive Effects	Total Amount of Bulbs Credited in 2010-2012*	gross kWh savings	gross kW savings	gross therm savings
PGE	*0.76*	*0.97*	*22,778,480*	*799,065,314*	*121,677*	*(14,936,476)*	*5,466,835*	*172,993,522*	*26,343*	*(3,233,670)*
Indoor CFL A lamp	0.76	0.97	3,826,344	125,213,130	17,354	(2,501,103)	918,323	27,107,997	3,757	(541,476)
Indoor CFL Basic	0.76	0.97	15,862,734	548,006,303	86,196	(9,971,811)	3,807,056	118,640,540	18,661	(2,158,846)
Indoor CFL Reflector	0.76	0.97	3,089,402	125,845,881	18,127	(2,463,562)	741,456	27,244,985	3,924	(533,348)
SCE	*0.77*	*0.97*	*39,806,436*	*1,610,930,070*	*248,996*	*(22,492,563)*	*9,155,480*	*332,150,530*	*51,339*	*(4,637,642)*
Indoor CFL A lamp	0.77	0.97	6,775,163	270,468,040	37,681	(3,823,066)	1,558,287	55,766,606	7,769	(788,261)
Indoor CFL Basic	0.77	0.97	24,663,864	991,239,682	160,091	(13,832,918)	5,672,689	204,379,316	33,009	(2,852,148)
Indoor CFL Globe	0.77	0.97	1,294,388	34,857,381	5,875	(428,526)	297,709	7,187,089	1,211	(88,356)
Indoor CFL Reflector	0.77	0.97	7,073,021	314,364,967	45,349	(4,408,053)	1,626,795	64,817,519	9,350	(908,877)
SDGE	*0.76*	*0.97*	*7,365,070*	*230,790,015*	*31,781*	*(2,898,082)*	*1,767,617*	*49,964,849*	*6,880*	*(627,420)*
Indoor CFL A lamp	0.76	0.97	475,819	14,235,134	1,945	(191,507)	114,197	3,081,833	421	(41,460)
Indoor CFL Basic	0.76	0.97	6,100,808	194,346,337	26,751	(2,425,338)	1,464,194	42,074,980	5,791	(525,073)
Indoor CFL Globe	0.76	0.97	128,131	2,358,285	382	(27,761)	30,751	510,557	83	(6,010)
Indoor CFL Reflector	0.76	0.97	660,312	19,850,260	2,703	(253,476)	158,475	4,297,479	585	(54,876)
Grand Total	*0.76*	*0.97*	*69,949,986*	*2,640,785,399*	*402,454*	*(40,327,121)*	*16,787,997*	*571,716,426*	*87,129*	*(8,730,614)*

** Could have been credited in subsequent years*

Bulb Flow Accounting Transition from 2010-2012 to 2013-2014

To develop a transition from our previous policy (carrying-over of stored bulb savings into future portfolios) to a policy in which savings are credited to the utility in the year the bulbs are sold, staff employed a four step process.

Step 1: Determine a cap for the total amount of energy savings from residential upstream CFLs that could be claimed for 2013-2104 as a percent of the total 2013-2014 portfolio energy goal for each IOU.

Staff selected a cap of 16%, which represents all of the market potential identified in the potential study for CFLs in the most recent Potential Study[1] (12% of total energy goals) plus an additional 4% of total energy goals for bulbs sold in 2013-2014 with the expectation that they would be stored for use in future years.

Step 2: Sum the amount of 2013-2014 savings from CFLs that were already claimed by each IOU.

Table K-2 compares the first six quarters of tracking data from the 2013-2014 upstream lighting program activity for residential CFL A-lamps, Basic, and Reflectors with the total amount of potential for these measures identified in the most recent Potential Study. (Note that SCE and SDGE are already claiming more CFLs than the estimated available potential.)

1 http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Energy+Efficiency+Goals+and+Potential+Studies.htm

Table K-2 -2013-2014 Claims compared to Potential

	13-14 Claims GWh	13-14 Potential GWh	Claims > Potential
PGE (A-lamp, Basic, and Reflector CFLs)	44.87	115	No
SCE (A-lamp, Basic, and Reflector CFLs)	141.41	94	Yes
SDGE (A-lamp, Basic, and Reflector CFLs)	44.48	29	Yes

Step 3: Calculate the remaining "headroom" of 2013-14 savings that could come from 2010-2012 carry over CFLs by subtracting the total 2013-2014savings developed in Step 2 from the cap developed in Step 1.

A comparison of the 2013-2014 claims as a percent of energy goals adopted in D.12-05-015 indicates that CFL claims for 2013-2014 already represent approximately 4% of PG&E's goals, 11% of SCE's goals, and 14% of SDG&E's goals based on ex ante 2013-2014 parameters.

Subtracting these 2013-2014 claims from the cap of 16% of total energy goals, Columns C and D in Table 3 represent the maximum GWh and percentage of 2013-2014 goal savings that 2010-2012 carry-over bulbs can contribute to each utility's 2013-2014 portfolios to reach the proposed 16% of goal total CFL cap (again, based on 2013-2014 ex ante parameters – the portion of 2013-2014 goals that will be represented by CFL bulbs in an evaluated basis will not be determined until 2013-2014 impact studies have been completed). Column E shows how much this amount represents compared with the total amount of carry

over bulbs available from 2010-2012 based on the previous carry-over model.

Table K-3 - Maximum Amount of Carry Over

	13-14 Tracking as a percent of 13-14 goals	If IOU are allowed to claim at most 16% of goals from current CFL + carry over, this amount would come from carry over from 2010-2012 (GWh)	Max percent of goals to come from carry over	Percent of carry over total
PGE	4%	146	12%	84%
SCE	11%	73	5%	22%
SDGE	14%	6	2%	13%

Step 4: Allow the IOUs to select the number of 2010-2012 bulbs they elect to carry over into 2013-2014 from between zero (all savings from 2010-2012 bulbs are credited in 2010-2012) to the maximum identified in Step 3.

[This section, which will provide and summarize a table with total 2010-2012 evaluated savings, will be developed after IOUs have commented on the draft document / provided their respective elections of the percentage of their 2013-2014 savings goals that will be met with 2010-2012 carry over bulbs up to their respective caps.]

Table K-4 - 2010-2012 Evaluated Savings

2010-2012 Upstream Lighting Impact Report	Ex ante IR	Ex Post IR	Sum of Qty	Sum of Combined evaluated Gross kWh Interactive Effects	Sum of Combined evaluated Gross kW Interactive Effects
PGE	**0.76**	**0.97**	**22,778,480**	**799,065,314**	**121,677**
PGE (w/Carry over removed)			18,545,480	653,071,350	99,268
Lighting Indoor CFL A lamp	0.76	0.97	3,826,344	125,213,130	17,354
Indoor CFL A lamp removed			560,000	17,697,125	2,441
Lighting Indoor CFL Basic	0.76	0.97	15,862,734	548,006,303	86,196
Indoor CFL Basic removed			3,000,000	100,796,099	16,009
Lighting Indoor CFL Reflector	0.76	0.97	3,089,402	125,845,881	18,127
Indoor CFL Reflector removed			673,000	27,500,740	3,959
TOTAL REMOVED for PGE			***4,233,000***	***145,993,964***	***22,409***
SCE	**0.77**	**0.97**	**39,806,436**	**1,610,930,070**	**248,996**
SCE (w/Carry over removed)			37,974,436	1,537,926,036	237,597
Lighting Indoor CFL A lamp	0.77	0.97	6,775,163	270,468,040	37,681
Indoor CFL A lamp removed			117,000	4,574,313	650
Lighting Indoor CFL Basic	0.77	0.97	24,663,864	991,239,682	160,091
Indoor CFL Basic removed			1,600,000	63,356,302	10,018
Lighting Indoor CFL Globe	0.77	0.97	1,294,388	34,857,381	5,875
Lighting Indoor CFL Reflector	0.77	0.97	7,073,021	314,364,967	45,349
Indoor CFL Reflector removed			115,000	5,073,419	730
TOTAL REMOVED for SCE			***1,832,000***	***73,004,034***	***11,399***
SDGE	**0.76**	**0.97**	**7,365,070**	**230,790,015**	**31,781**
SDGE (w/Carry over removed)			7,155,070	224,393,945	30,902
Lighting Indoor CFL A lamp	0.76	0.97	475,819	14,235,134	1,945
Indoor CFL A lamp removed			50,000	1,461,811	200
Lighting Indoor CFL Basic	0.76	0.97	6,100,808	194,346,337	26,751
Indoor CFL Basic removed			110,000	3,440,359	475
Lighting Indoor CFL Globe	0.76	0.97	128,131	2,358,285	382
Lighting Indoor CFL Reflector	0.76	0.97	660,312	19,850,260	2,703
Indoor CFL Reflector removed			50,000	1,493,901	203
TOTAL REMOVED for SDGE			***210,000***	***6,396,070***	***879***
Grand Total	0.76	0.97	69,949,986	2,640,785,399	402,454
TOTAL REMOVED STATEWIDE			***6,275,000***	***225,394,068***	***34,686***
Grand total (with Carry-over removed)			63,674,986	2,415,391,331	367,768